MTBE PHASE OUT IN CALIFORNIA

DRAFT

Study Conducted By

Stillwater Associates

For

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ACKNOWLEDGEMENTS

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Valuable contributions to this report were also made by Anthony J. Finizza, Ph.D., who contributed his insights on the market dynamics and price elasticity, as well as the economic impact of market shortages on the California economy, and by J. Drew Laughlin, who provided the US Gulf Coast supply perspective with regard to California s supply/demand balance for transportation fuels.

Equally, this study is based in large part on information received in the context of a feasibility study for a Strategic Fuels Reserve during meetings with industry stakeholders, such as the California refiners, representatives of the international trading community, independent marketers, trade associations, government organizations such as the State Lands Commission and Port Authorities. The authors wish to thank all those who readily volunteered information and opinions for their contributions and the openness with which information was shared.

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GLOSSARY

ANS	Alaska North Slope, term used to designate crude oil of that region
ARB	Air Resources Board
BP	British Petroleum
CAA	Clean Air Act of 1977
CAAA	Clean Air Act Amendments of 1990
CAAA Title V	Section of the CAAA requiring Operating Permits, promulgated in 1992
CARB	California Air Resources Board
CARBOB	California Reformulated Gasoline Base Oxygenated Blendstock
CEC	California Energy Commission
CMAI	Chemical Markets Associates, Inc.
cpg	Cents per gallon
CSLC	California State Lands Commission
DOE	Department of Energy
EIA	Energy Information Agency
ETBE	Ethyl tertiary Butyl Ether (type of oxygenate)
FCC	Fluidic Catalytic Cracker (primary gasoline production unit in a refinery)
OPA 90	Oil spill Prevention Act of 1990
OPIS	Oil Price Information Service
p.a.	Per annum
PADD	Petroleum Administration Defense District
PoLA	Port of Los Angeles
PoLB	Port of Long Beach
RFG	Reformulated Gasoline meeting the requirements of the CAAA
RVP	Reid Vapor Pressure (measure of gasoline volatility)
SCQAMD	South Coast Air Quality Management District
SFR	Strategic Fuels Reserve
TBD	Thousand Barrels per Day
VLCC	Very Large Crude Carrier, tankers capable of carrying 1.5 —2 million bbl
VMT	Vehicle Miles Traveled

BACKGROUND

In August 2001, Stillwater Associates was retained by the California Energy Commission (CEC) to conduct a study into the necessity and feasibility of creating a Strategic Fuels Reserve for California, pursuant to Assembly Bill 2076. A comprehensive supply and demand balance of fuels for the State was an essential input for this study, for which the timing of the MTBE phase-out constituted a key factor. Inputs gathered from the industry during a series of stakeholder meetings and through an analysis of supply and demand data led Stillwater to believe that a significant supply shortfall would result if the phase out were to proceed as scheduled by year-end 2002.

Separately, the CEC had commissioned a study with J. Drew Laughlin, a Houston based consultant, to examine the availability of supplies and means of transportation for sourcing California s anticipated gasoline and component shortfall from the US Gulf Coast. Independently, Mr. Laughlin s analysis confirmed the magnitude of the problem and the inability of Gulf Coast refiners to supply California.

Given the urgency of the matter, the CEC charged Stillwater in late January 2002 to amplify the ramifications of the MTBE phase out, in particular with regard to supplies of gasoline and blending components that would have to make up for the anticipated net volume losses that result when ethanol is substituted for MTBE in the State s gasoline pool.

The approach taken by Stillwater and the CEC for this study is to:

(i) Use the results of a survey conducted for the Strategic Fuels Reserve study amongst industry stakeholders, such as refiners, traders, logistic survey providers, and other concerned parties such as industry associations representing independent gasoline marketers, port authorities, and market intelligence providers. The purpose of the survey was not only to gather relevant information and data such as supply and demand factors, but also to gain a full understanding of market mechanisms and barriers to entry that contribute to the price spikes that a reserve aims to prevent.

(ii) Base demand forecast on an as yet unpublished CEC report.

(iii) Use the most recent aggregate data from the refiners CARB Phase III Compliance Plans and an analysis of factors that contribute to capacity creep to produce a forecast of indigenous California refinery gasoline production.

(iv) Use data from public sources such as EIA and DOE to predict availability of gasoline and blending components from other US sources outside California, as well as for the shipping capacity and pipeline developments to deliver these products to the State.

(v) Use published data where available to predict price elasticity and conduct additional analysis on available California specific data.

(vi) Develop alternative scenarios around the impact of supply shortfalls taking into account such factors as economic recovery, demand in other markets and possible supply disruptions.

(vii) Develop alternative solutions for phasing out MTBE, taking into account measures that can be implemented during the intervening period.

(viii) Evaluate next steps and implementation plans, and identify potential barriers to implementation, such as delays in permitting processes.

(ix) Collect feedback from the industry in an open forum workshop, and adjust where necessary the recommended alternatives.

(x) Present the final conclusions and recommendations to the legislature.

For this study, the availability of ethanol needed to supply the needs of California, which has been the subject of several prior studies, was taken as a given. The logistic problems associated with the supplies of ethanol from the US producing states into the California gasoline system will only be analyzed insofar these problems may be resolved in part by infrastructure freed up by the MTBE phase out.

EXECUTIVE SUMMARY

The primary conclusions from the study are:

(i) The California refining capacity has not been able to keep up with demand growth. As a consequence, the State has become a significant net importer for all its petroleum products.

(ii) Permit restrictions hamper capacity additions, and massive investments made by the refining industry over the past decade have been directed at compliance with regulatory programs resulting in capacity reductions rather than increases.

(iii) Imports of gasoline and gasoline blending components currently account for approximately 15% of the State s demand, two-thirds of which is MTBE.

(iv) The geographical insularity of California s gasoline market has been aggravated by the uniqueness of its fuels specifications, and domestic or foreign sources of alternative supplies are scarce.

(v) Inadequate logistics and commercial factors such as lack of liquidity in forward markets and restrictions imposed by the Unocal patents constitute significant barriers for imports. The gasoline supply system is currently constrained with demand exceeding the existing infrastructure capacity.

(vi) The combination of restricted refining capacity, inadequate logistics infrastructure, and commercial barriers has made the California gasoline market increasingly unstable, with even small supply disruptions causing major price swings.

(vii) Phase out of MTBE by year-end 2002 will result in a supply shortfall in the range of 55 to100 TBD (thousand barrels per day). Given the current instability of the California gasoline market and the inadequate logistic infrastructure, this is likely to lead to prolonged shortages similar to those observed — but only over short periods —in 1999 when prices doubled and a waiver for supply of non-conforming gasoline was granted.

(viii) Over 80% of the net shortfall caused by the phase out of MTBE will fall to Southern California, and to the Arizona and Nevada markets supplied from the Los Angeles Basin. Unfortunately, the LA Basin is also where most of the infrastructure problems occur.

(ix) Based on generally accepted price elasticity estimates and recent California market experience, gasoline prices will have to double before demand will find a new equilibrium at a level that matches the reduced supply, causing significant damage to the State s economy. The consequences will have the greatest impact in the independent market sector, supplying institutional buyers such as government agencies, and will disproportionately impact lower income groups.

(x) Permitting restraints and unavailability of emission credits make timely additions of refining capacity within the California system unlikely. These same factors are also expected to make it difficult for refiners to maintain the rate of ongoing small increases in refining capacity, which in recent years averaged 1% per year.

(xi) A waiver from the federal requirement for oxygenates will improve the flexibility for refiners to source blending components and base blendstocks after MTBE is phased out. The waiver will make the supply system less vulnerable to potential ethanol logistic problems, but will not significantly alter the overall supply shortfall.

(xii) The shortfall cannot be met from refineries on the US Gulf Coast, which are currently running at capacity, are unable to produce Phase III CARBOB, and may be curtailed in their ability to produce alkylates for export by anticipated developments in other US gasoline markets and worldwide petrochemical demand.

(xiii) Even if product could be made available on the US Gulf Coast, American flag shipping will not be available in sufficient numbers, while the OPA 90 impact in years to come is going to reduce the availability of US flagged product tankers even further.

(xiv) Imports of blending components from worldwide sources will be attracted to California when prices are elevated to unprecedented levels above world markets over prolonged periods. However, while MTBE is a single, readily fungible component, the replacements are likely to be a wide variety of blendstocks such as ethanol, alkylates, isomerate, isooctane, and near-conforming gasoline stocks, each requiring separate storage and —in the case of ethanol —handling facilities. The combined infrastructure demands of the replacements are far more complex than the current MTBE facilities.

(xv) Several physical and commercial barriers that currently already limit the State s capability to import these blendstocks will increasingly become a supply obstacle:

- Tankage for clean products, which is currently already severely constrained in the LA basin, will be reduced by 10 to 15% over the next 7 years by the need to comply with a new regulation from the SCAQMD (Rule 1178) requiring tank modifications to obtain further emission reductions.
- Permitting, port policies and pressure from to special interest groups make it unlikely that additional terminal capacity can be constructed within the timeframe necessary to mitigate the economic impact. In fact, port policies may well lead to further terminal closures in the near future.

- Concerns about violating the Unocal patents currently prevent traders, foreign suppliers or California s remaining independent marketers from attempting to import components and blend finished gasoline. After the introduction of CARB Phase III and the elimination of MTBE as primary blending component, these difficulties will significantly increase.
- The California refiners control, either through outright ownership or long-term leases, virtually all of the available terminal capacity in the State. The refiners are also the only ones capable of blending around the Unocal patents. The primary responsibility of the refiners in times of product shortage is to keep their branded retailers supplied. This means that the shortfall will primarily affect the independents, who in the current tight storage market, have no access to tankage or supplies from traders.
- The California gasoline market lacks liquidity in forward markets and does not offer mechanisms to hedge forward risk, leaving importers exposed to price uncertainty. On average, the California prices are substantially higher than the world markets, but the price volatility is such that an importer would be exposed to the risk that a downswing will occur during the 6 to 8 weeks it takes to source and ship a cargo. In a highly volatile market, many importers will not conduct a trade that has a significant unsecured price risk over periods that long.

To avoid shortfalls and subsequent price excursions, the following preliminary recommendations are formulated:

(xvi) The MTBE phase out should be deferred for a sufficient period of time to allow actions to be taken that will result in significant additional supplies becoming available to augment the California gasoline pool. Events that are anticipated to do this are:

- In Northern California: the restart of idled capacity, which could provide an additional 22 TBD of conforming gasolines.
- In Southern California: the extension of the Longhorn pipeline to Phoenix, AZ, which will enable additional supplies of gasoline to be transported from the East, thus allowing 70 to 90 TBD to remain in the CA market that is currently exported to Phoenix from Southern California refineries.
- Additions of terminal and tank capacity in the Bay Area and the LA Basin, which will enable access to the CA market by traders and foreign producers.
- Resolution of the Unocal patent(s) currently under review by the Patent Office, and/or settlement of suits brought by several majors so that refiners can again blend in components currently diverted from the gasoline pool to avoid patent infringement.

(xvii) A deferral of the MTBE phase out until November of 2005 should be sufficient to complete the necessary steps to ensure that a transition to ethanol can be accomplished with minimal disruption to gasoline supplies, with least cost to California consumers.

(xviii) The intervening period of three years must be used to:

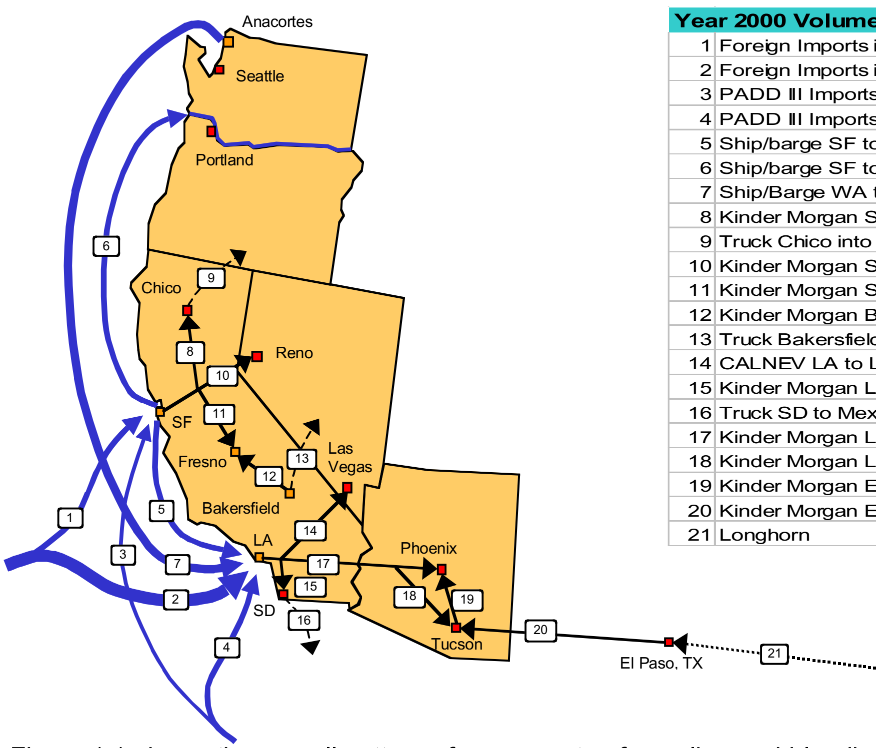
§ Identify ways to allow refiners to expand capacity in cost effective ways, with permitting procedures revised to enable one-stop, fast track processing, similar to that introduced to resolve the electricity crisis.

§ Implement the recommendations of the CEC s Strategic Fuels Reserve Study, which are being developed in parallel to this MTBE study. The preliminary recommendations of the SFR study are to create additional storage, as well as means to promote forward liquidity.

1 CURRENT CALIFORNIA GASOLINE SUPPLY

Refiners in the LA Basin and the Bay Area, California s major refining centers, supply the bulk of gasoline consumed in the State, as well as in parts of Oregon, Arizona and Nevada. A third, much smaller refining center is located in Bakersfield. The refiners boost their production by importing blendstocks as well as finished or semi-finished gasoline.

Figure 1.1 — CA 2000 Gasoline Movements, Including Blendstocks[1]



	Year 2000 Volumes	TBD
1	Foreign Imports into N-CA	29.8
2	Foreign Imports into S-CA	68.4
3	PADD III Imports into N-CA	6.8
4	PADD III Imports into S-CA	22.1
5	Ship/barge SF to LA	24.5
6	Ship/barge SF to Portland	28.0
7	Ship/Barge WA to LA	38.0
8	Kinder Morgan SF to Chico	17.6
9	Truck Chico into S-OR	0.4
10	Kinder Morgan SF to Reno	17.3
11	Kinder Morgan SF to Fresno	n/a
12	Kinder Morgan B'field to Fresno	n/a
13	Truck Bakersfield to W-NV	2.5
14	CALNEV LA to Las Vegas	45.9
15	Kinder Morgan LA to San Diego	n/a
16	Truck SD to Mexico	n/a
17	Kinder Morgan LA to Phoenix	60.9
18	Kinder Morgan LA - Tucson	4.1
19	Kinder Morgan El Paso - Phoenix	41.0
20	Kinder Morgan El Paso - Tucson	28.0
21	Longhorn	

Figure 1.1 shows the overall pattern of movements of gasoline and blending components into and out of the State. The Bay Area is currently still a net exporter, supplying parts of Oregon, Northern Nevada and Southern California. The LA basin is a large import center, and maritime movements into the State are primarily concentrated into the ports of Los Angeles and Long Beach. Below, the production capabilities and import trends will be analyzed in more detail.

1.1 Refining Capacity in California

Historically, two factors have contributed to rationalization and concentration of refining capacity in California:

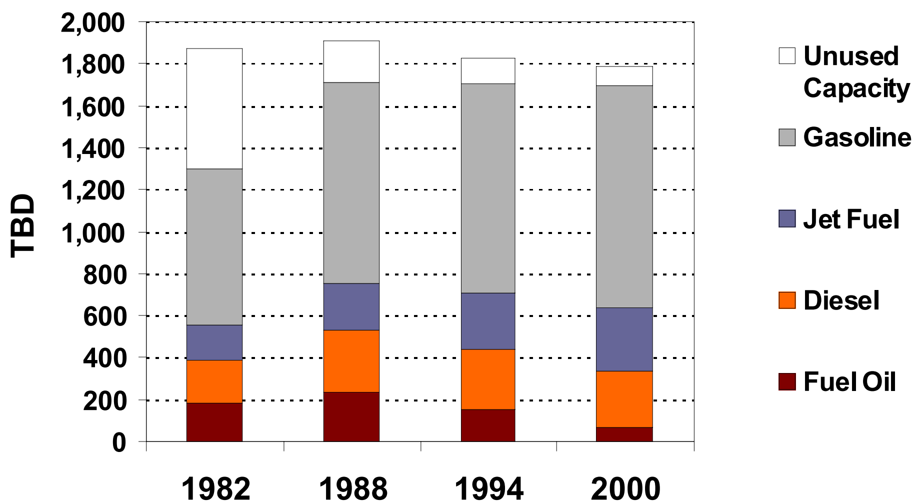
[1] Sources: EIA, CEC, and port statistics collected by the US Army Corps of Engineers

§ The deregulation of the markets for petroleum products in 1981[2], which accelerated the closure of many uneconomic refineries.

§ The requirements to produce cleaner burning gasolines following federal and state legislation enacted over the period 1990 through 1995, which for several refineries could not be achieved economically.

The concentration of production that took place from the mid 1980s through the mid 1990s has not only resulted in high utilization rates of remaining capacity, but the investment programs to meet the requirements of the CAA and subsequent amendments also led to a significant increase in gasoline production of lighter components at the expense of heavy fuel oil. As a result, the remaining gasoline-producing refineries in California are highly sophisticated, full conversion facilities, and are amongst the most efficient refineries in the world.

Figure 1.2 — CA Refinery Capacity Utilization[3]

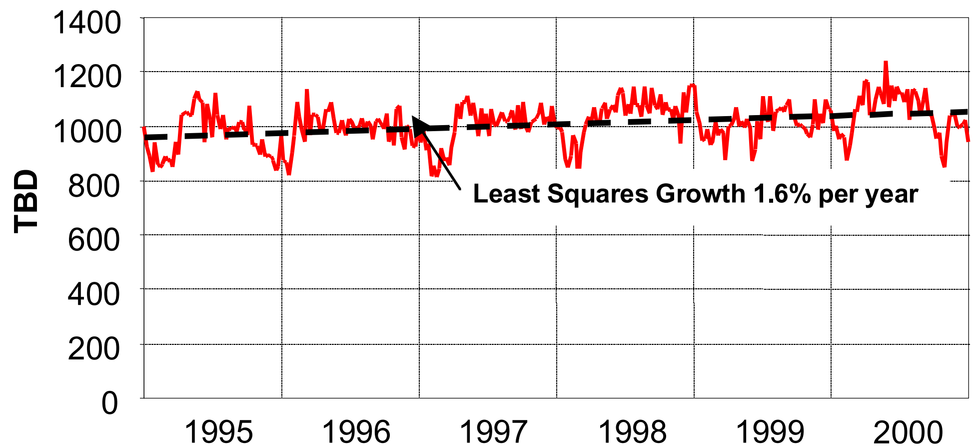


Over the past decade, the California refiners have invested vast amounts of money into upgrades of their aging refineries to meet the requirements, first of the Clean Air Act Amendment in the early nineties, followed by the introduction of CARB Phase II reformulated gasoline in the mid-nineties, and currently again in preparation of CARB Phase III. Although all these investments have led to an apparent increase in gasoline production, imported MTBE and other blendstocks account for a large share of the increased output, and overall crude runs have declined.

[2] Executive Order 12287, Providing for the Decontrol of Crude Oil and Refined Petroleum Products, Jan 28, 1981.

Figure 1.2 shows how since the mid 1990s, unused refining capacity has decreased to less than 5%, indicating that all remaining refineries in California have essentially been running at the maximum practically feasible operating rate given the average age and the mechanical complexity of the installations. It also shows that the remaining refining capacity is predominantly geared towards production of gasoline at the detriment of fuel oil output, as a result of major investments into cracking and coking capacity in the late 1980s and early 1990s. More recently however, increases in gasoline production have stalled. Figure 1.3 shows the weekly reported gasoline production of California refineries.

Figure 1.3 — CA Weekly Reported Gasoline Production



Gasoline supplies by California refineries have grown on average by 1.6% per annum over the period 1995 through 2000, for an overall increase in average reported gasoline production of close to 100 TBD. Of this additional volume, approximately 30 TBD is the result of increased imports of components and blendstocks by refiners, which gets reported as production after being blended off (see Figure 1.6 below). The remainder, or 70 TBD, is the effect of capacity creep in refineries (the result of minor expansion projects and ongoing improvements in operations), which equates to approximately 1% per year. Although insignificant as fraction of total supply, capacity creep is important because it can represent over half of the anticipated increase in demand.

In a market where supplies are tight, and where an economic justification for small improvement projects can readily be found, capacity creep is likely to continue at historical rates. However, it is becoming increasingly difficult for refiners to expand capacity even by small increments because of restrictions imposed by their Clean Air Act Amendment Title V operating permits, and the costs of additional emission credits in the absence of feasible

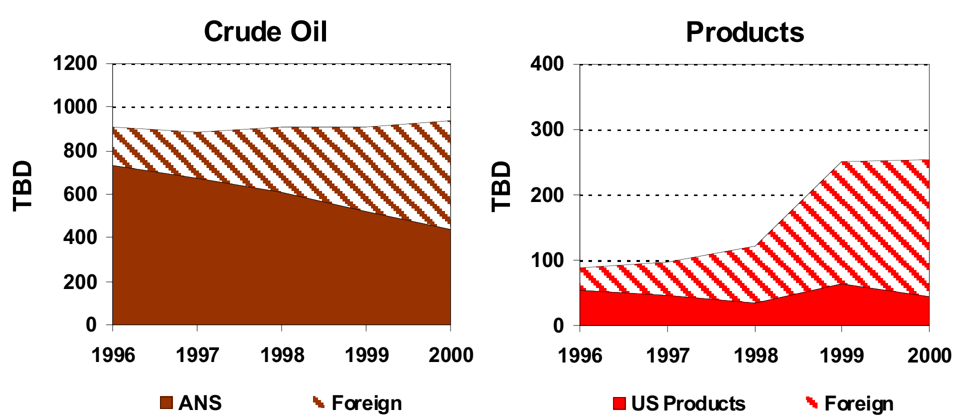
[3] Source: EIA Data

offsets. Given that refiners already have had ample incentive and opportunity to increase capacity over the past years, and that the regulatory framework in which they can realize these modifications is finite, it is fairly optimistic to estimate that creep will continue at 1% per year. Yet for the base case projections, this is what will be assumed.

1.2 Imports of Petroleum and Petroleum Products into California

In the past, California was a net exporter of petroleum, either as crude oil or as refined distillates and partially refined feedstocks. In recent years however, internal demand has grown and even though the refineries have become more sophisticated as California crude oil production has declined, the net effect is that imports of both crude oil and refined products have grown substantially, making the State a significant net importer of foreign crude and petroleum products, as shown in Figure 1.4.

Figure 1.4 — CA Waterborne Imports of Crude & Products[4]

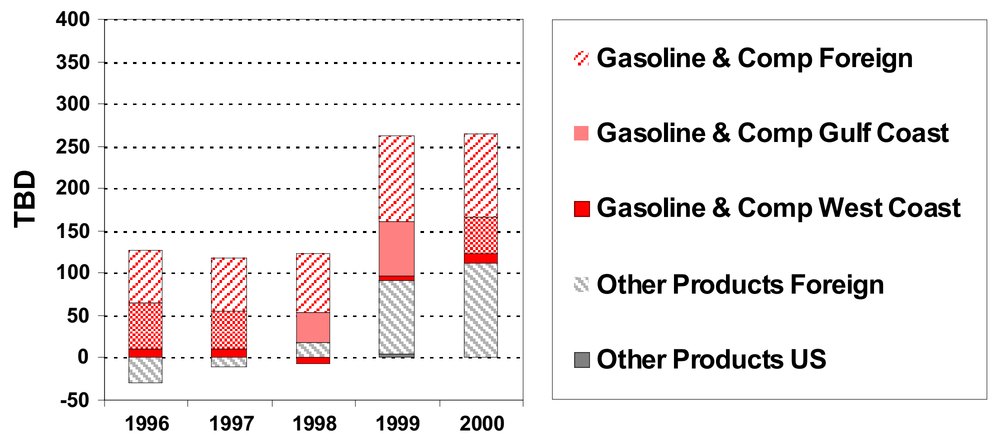


Over the past 5 years, imports of foreign crude oil into California have effectively tripled, from about 177 TBD in 1996 to nearly 500 TBD in 2000. While refinery crude runs have been nearly constant, the increased foreign imports are replacing primarily Alaska North Slope crude (ANS), and will also have to compensate for declining California crude production in the near future. A significant portion of the foreign crude oil is sourced from remote locations such as the Arabian Gulf, requiring movements in much larger tankers (VLCCs) to be cost effective. This in turn puts an additional strain on the terminals and receipt facilities at the refineries, and increases the overall vulnerability of California s energy supplies.

[4] Data: EIA, CEC, US Army Corps of Engineers Port Statistics

California s increasing import dependence and the additional demand on marine terminals is even more pronounced for product movements [5]. Over the past five years, net product imports have more than doubled, staying at a level of over 250 TBD in 2000, after they had shot up rapidly in 1999 because of poor refinery performance. Imports of gasoline and gasoline components are a function of refinery performance and market demand. The California refineries operated reliably in 1998, but significant refinery problems were encountered in 1999. Gasoline imports peaked at about 165 TBD in 1999, of which almost 100 TBD were of foreign origin, and remained at high levels in 2000. Of the increased volumes, a significant share can be attributed to jet fuel, but the majority of the imported petroleum products still consists of gasoline and gasoline components, including oxygenates. Figure 1.5 shows the details of the product imports by origin and composition.

Figure 1.5 — CA Product Imports by Origin and Composition



As can be seen in Figure 1.5, while in 1996 California still was a net exporter of distillates and miscellaneous refined products, it now has a net import requirement for all product categories. Moreover, while in 1996 foreign imports accounted for approximately 50% of California s imported shortfall of gasoline and blending components, by 2000 the share of foreign imports had grown to almost 70%. It is important to note that in fact, the entire increase in California s imports of gasoline over the period has been met by foreign imports rather than imports from other US markets.

The increasing dependency on foreign imports represents significant exposure for the future capability to keep the State supplied with gasoline because only a limited number of foreign refineries is capable of producing CARB spec fuels, and this number will shrink even further as

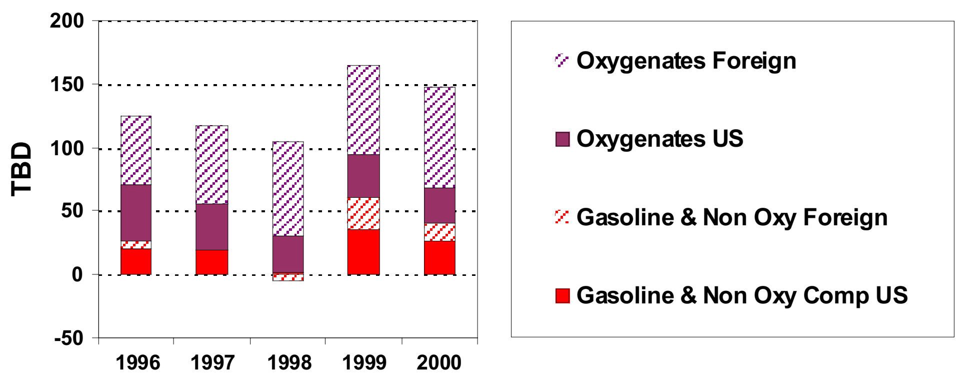
[5] Based on data from EIA, CEC and Port Statistics kept by the US Corps of Engineers

some of these refiners will not be able to produce CARB Phase III CARBOB. To the foreign refiners, exports to California are only an incidental occurrence with uncertain margins given the shipping delays, the volatility of the California market, and the lack of a forward or futures market. Under these conditions, it is difficult for these refiners to invest in the necessary upgrades.

The import volumes shown in Figure 1.5 for the West Coast represent the balance of imports and exports to the Pacific Coast states, which have a considerable volume of petroleum movements between the various producing and consuming enclaves. Refineries in California ship conventional gasoline to the Pacific Northwest, primarily Portland, OR. The refineries on Puget Sound send somewhat larger volumes of reformulated gasoline or components down to San Francisco Bay or Los Angeles by tanker or barge.

The imports into the gasoline pool are a combination of finished gasoline, blending components and oxygenates. Components include alkylate, naphtha, reformate, raffinate, and natural gasoline. Oxygenates in the form of MTBE, ETBE, and ethanol make up the largest part of the imported shortfall of gasoline in California, with MTBE representing over 90% of these volumes. Figures 1.6 shows a breakdown of gasoline imports by major component.

Figure 1.6 — Imports of Gasoline & Components

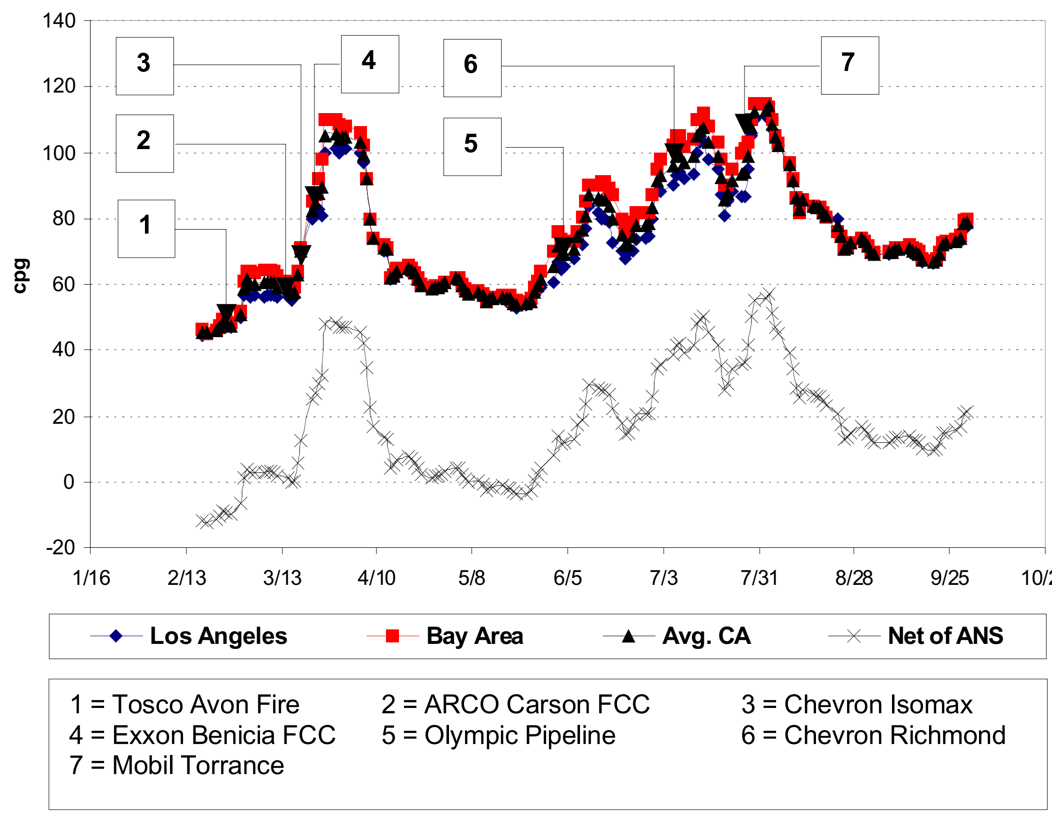


As can be seen in Figure 1.6, oxygenates, of which MTBE makes up over 90%, have remained fairly constant over the past 5 years, but while in 1996 imports of MTBE from the US Gulf Coast still made up almost half of the total landed volumes in California, by 2000 this percentage was reduced to 26%. The net imports of gasoline and blending components other than oxygenates fluctuate substantially from year to year, reflecting operational reliability of California s refineries.

1.3 Supply Reliability Factors

When refiners state calendar day capacity (actual expected annual production divided by 365 days) and stream day capacity (highest operating rate sustainable on a single day), the difference for major refinery units such as distillation or cracking is typically around 5%. This means that refiners expect that on average, these installations will be out of service for 18 days per year for scheduled inspections, preventive maintenance, operational activities such as catalyst changes, and project work. Since 1995, the California refineries have been running at operating rates approaching 95% of published nameplate capacity, which means that effectively, they have been running as close to their maximum sustainable rates as can be expected, given the age and complexity of the installations, and this operating record reflects favorably on the skill level and experience of operating personnel and refinery management.

Figure 1.7 — 1999 CA Refinery Outages and Price Spikes

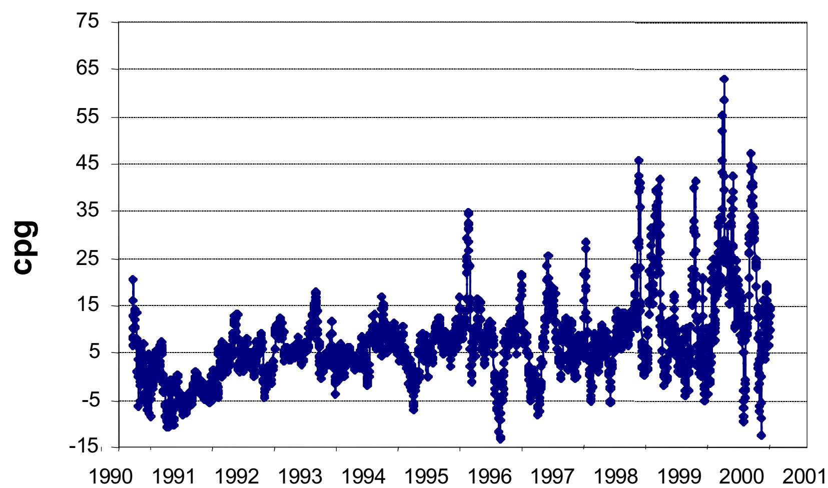


Nevertheless, unplanned outages occur, sometimes for reasons that are completely outside the scope of control of the refinery management. For all of California s refineries combined, evidence was found in publicly available information that in the last 6 years, at least 54 outages occurred with measurable effect on production capacity. Of these, most are relatively minor events, with a production loss averaging 20 TBD over a period of less than 4 weeks. However, over this period there were 7 major events involving production losses ranging from 50 to 160 TBD and lasting up to 8 weeks.

With inventories on hand that average only 10 days of supplies, and with long supply routes requiring lead times of 6 to 8 weeks for imports, the effect of supply disruptions is to cause temporary shortages that in turn result in a market driven price spike, with prices running up until demand will be reduced to a level that corresponds with the reduced supplies. Given the very un-elastic price/demand behavior of gasoline, even small shortfalls in supply can cause very significant price swings. For instance, the 1999 refinery incidents shown in Figure 1.7 above resulted in a capacity loss of 5 — 10%, and caused prices to double. There is also ample evidence, as Figure 1.7 suggests, that even if incidents are confined to only one of the California refining centers, the entire California gasoline market moves up.

The best evidence that the California gasoline market is severely supply constrained, and is becoming increasingly unstable, is an analysis of how California s gasoline prices compare to those elsewhere in the US.

Figure 1.8 — US Gulf Coast to CA Gasoline Price Differential



From Figure 1.8, it is clear that there is a rising trend with increasing volatility in the premium that California is paying over the Gulf Coast for its gasoline supplies. But while a price spike in 1996 was able to attract the equivalent of 50 TBD in supplies from the US Gulf Coast, subsequent sustained and higher price differentials in 2000 have not resulted in more than the equivalent of 12 TBD to be shipped from the Gulf Coast.

The extreme nature of the price spikes, with prices that are over prolonged periods at levels where an importer would make $3 to 5 million clear profit on bringing in a single cargo if only he could find the product and a tank to land it in, are a clear sign that significant physical and commercial barriers are preventing efficient supplies of gasoline blendstocks and components into California.

Against this backdrop, it will be understood that the phase out of MTBE, the only blendstock that is readily available and for which efficient logistic systems are in place, and which constitutes over 10% of the entire gasoline pool, will without any doubt result in a aggravation of the already instable gasoline supply chain and pose significant problems for California and the neighboring states that rely on California s infrastructure for their gasoline supplies.

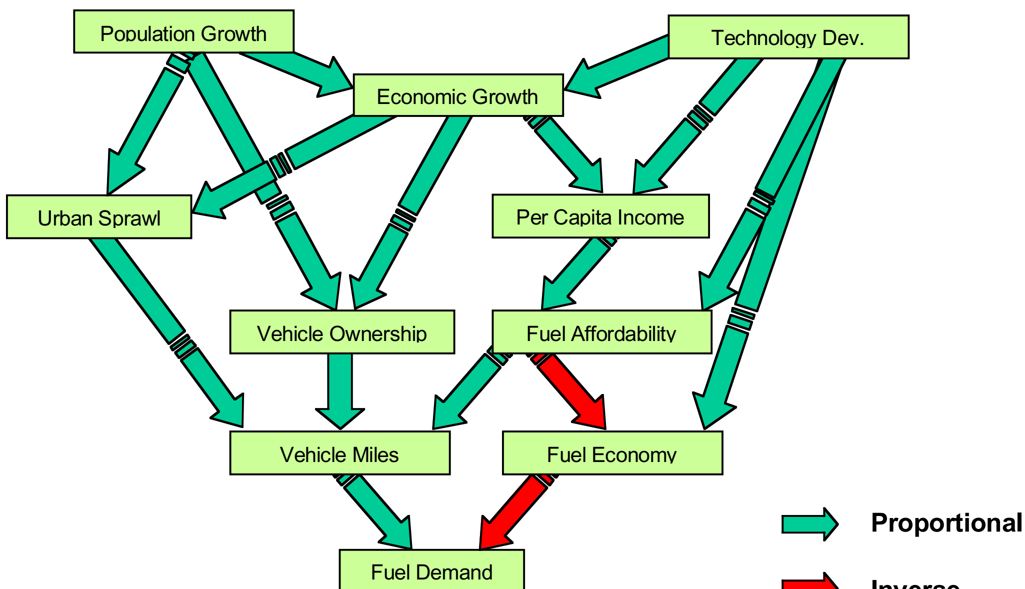
2 CALIFORNIA GASOLINE DEMAND

To estimate future demand for gasoline in California, this report will make extensive use of the results of a separate study launched by the CEC concurrently, with the specific purpose of forecasting energy demand in the State [6]. The main findings of this study are summarized below.

2.1 Growth Drivers

Demand for transportation fuels is the product of the total miles driven by all vehicles and the average fuel consumption per vehicle over the entire fleet. These two key factors, in turn are impacted by a complex set of interdependent factors as shown in Figure 2.1 below.

Figure 2.1 — Drivers for CA Gasoline Demand



For the key factors, the following historical and forecasted numbers were used:

§ **Population Growth**. Over the past two decades, California s population grew by an average of 1.9% per year, a rate that is expected to slow to 1.4% per year over the next 20 years, resulting in a total population of 45 million people in the State by 2020.

[6] Base Case Forecast of California Transportation Energy Demand, CEC Staff Report, December 2001

- **Population Density**. Land development patterns in California are characterized by urban sprawl, leading to jobs and communities that are increasingly further apart. This trend is expected to continue.

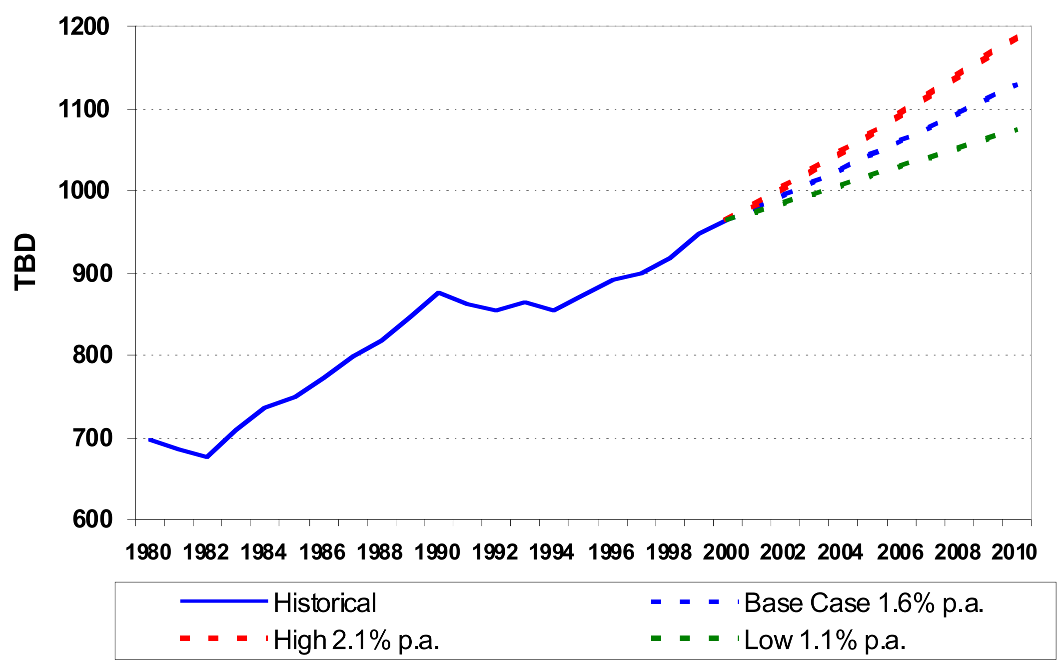
- **Fuel Affordability**. Over the past 20 years, the average annual increase in per capita income in California was 3.1% per year, for an aggregate real increase of 45% (1.9% per year). Over the same period, the real cost of gasoline in the State fell by 30%. Per capita income is forecasted to increase on average 1.5% per year, and primary energy cost to stay flat in constant dollar terms (the price of gasoline in CA may vary significantly depending on supply scenarios, but this effect is taken into account separately).

- **Vehicle Miles Traveled (VMT)**. The factors cited above contributed to an increase in total Vehicle Miles Traveled of 3.3% annually over the past 20 years. For the immediate future, the forecast is for an annual increase of 1.8%.

2.2 Historical and Forecasted Demand

Figure 2.2 shows the historical and forecasted demand of gasoline in California. There have been two periods in which demand of gasoline declined, in both cases as a result of a severe recession.

Figure 2.2 — CA Gasoline Demand



The forecasted base case growth percentage of 1.6% p.a. is equal to the underlying historical long-term growth in demand, through periods of recession and economic recovery.

It would take a significant worsening of the recession, possibly in combination with a simultaneous increase of gasoline prices corresponding to those of the early 1980s, when crude oil peaked at upwards of $30 per barrel, in order to create a scenario of flat growth or diminishing consumption of gasoline. Given that current indicators show that economic recovery is already underway and that crude oil is in oversupply, this scenario is unlikely in the near future. To the contrary, recent California data show that despite the economic slowdown, gasoline consumption in the State is still growing at more than 2% per year. From a supply planning perspective, it is therefore more realistic to assume a downside scenario that corresponds to a mild recession with gasoline consumption slowing down to an annual growth rate of 1.1%. The upside case assumes rapid economic recovery and a return to a growth rate in demand of 2.1%, similar to what was seen in recent years.

The demand scenarios assume a price level that is not substantially different from the historical levels, i.e., around $1.50 per gallon, and therefore represent the latent demand based on demographic and economic factors as outlined above. How much prices would have to deviate from the historical range in order to obtain different gasoline consumption numbers will be discussed in Section 5.

2.3 Total Demand for Gasoline Supplied from California

As shown in Figure 1.1 above, the California refining centers still supply significant quantities of gasoline and other fuels to neighboring states, including the fast growing urban centers of Las Vegas, NV, and Phoenix, AZ. Currently most of this demand is for conventional gasoline and the exported volumes provides those California refiners who are not capable of upgrading their total gasoline cut to CARB specifications.

In recent years, the development of gasoline demand growth in Nevada and Arizona has closely tracked population growth, and for these states, forecasts for future gasoline demand have therefore been pegged to the predicted population growth [7, 8]. It is further assumed that high growth in these states would be 1% per year above base case growth, while a reasonable

[7] Nevada State Energy Office: 2.9% in 2000, 2.8% in 2001, a decline assumed to continue. Also, Clark County Advanced Planning Division - "Clark County Demographics Summary"

[8] AZ Dept of Economic Security data - http://www.de.state.az.us/links/economic/webpage/page16.html

assumption for low growth is 1% below base case. The total demand for gasoline to be supplied from California is shown in Table 2.1 below.

Table 2.1 — Total Demand for California Sourced Gasoline

	TBD	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Base Case												
	Northern California	372	378	384	390	396	403	409	416	422	429	436
	Northern Nevada	17	18	18	19	19	20	20	21	22	22	23
	Oregon	28	28	29	29	30	30	31	31	32	32	32
		417	424	431	438	445	453	460	468	476	483	491
	Southern California	591	600	610	620	630	640	650	660	671	682	693
	Southern Nevada	41	43	45	47	48	50	51	53	54	55	56
	Western Arizona	87	91	95	99	102	106	0	0	0	0	0
		719	734	750	765	781	796	701	713	725	737	749
	Total CA Base	1136	1159	1181	1204	1226	1249	1161	1181	1201	1220	1240
High Growth Case												
	Northern California	372	380	388	396	404	413	421	430	439	449	458
	Northern Nevada	17	18	18	19	19	20	20	21	22	22	23
	Oregon	28	29	29	29	30	30	31	31	32	32	33
		417	427	435	445	453	463	472	483	493	503	514
	Southern California	591	603	616	629	642	656	669	684	698	713	728
	Southern Nevada	41	44	45	47	49	50	52	53	54	55	56
	Western Arizona	87	92	96	100	103	107	0	0	0	0	0
		719	739	757	776	795	813	721	737	752	768	784
	Total CA High	1136	1165	1192	1220	1248	1277	1194	1219	1245	1271	1298
Low Growth Case												
	Northern California	372	376	380	384	389	393	397	402	406	410	415
	Northern Nevada	17	18	18	19	19	20	20	21	22	22	23
	Oregon	28	28	29	29	30	30	31	31	32	32	32
		417	422	427	432	437	443	448	453	459	464	470
	Southern California	591	598	604	611	617	624	631	638	645	652	659
	Southern Nevada	41	43	45	46	48	49	51	52	53	54	55
	Western Arizona	87	90	94	98	101	105	0	0	0	0	0
		719	730	742	755	767	779	682	690	698	706	715
	Total CA Low	1136	1152	1169	1187	1204	1222	1129	1143	1157	1171	1185

3 IMPACT OF MTBE PHASE OUT ON SUPPLY AND DEMAND

Since it was first proposed to phase out MTBE, the impact of effectively removing 11% in volume from the current gasoline pool has been a source of concern [9]. In the absence of other viable alternatives, the federal requirement to maintain a minimum of 2% oxygen left only ethanol as a feasible substitute for MTBE as an oxygenate. It has always been recognized that there are major drawbacks associated with the use of ethanol versus MTBE, notably when meeting vapor pressure requirements during the summer blending season (which for 70% of California s gasoline consumption lasts 9 months), while other substitution problems are found in meeting distillation range requirements.

3.1 Volumetric Impact

The volumetric impact of replacing MTBE by ethanol while meeting the additional requirements of CARB Phase III can be summarized as follows:

Table 3.1 — Impact of MTBE Phase Out[10]

	TBD	N-CA	S-CA	Total CA
MTBE Balance				
	RFG production	386	549	935
	Ethanol Based CARB RFG	40	70	110
	MTBE Based CARB RFG	346	479	825
	MTBE Required @ 11%	38	53	91
	MTBE imports foreign	24	51	75
	MTBE imports US Gulf Coast	7	10	17
	MTBE production	7	3	10
	Total MTBE supply	38	64	102
	Excess MTBE	0	11	11
Direct Impact				
	Removal of MTBE	-38	-64	-102
	Ethanol addition for oxygen requirement	21	34	55
	Removal of butanes & pentanes	-17	-29	-46
	Other Losses to meet distillation specs	-4	-6	-10
		-38	-65	-103
Capacity Compensation				
	Major refinery capacity additions	22	0	22
	Small CARB III mods, MTBE C4 to alky	3	2	5
	Capacity Creep 2001 - 2002, 1%	4	6	10
	Identified blendstock imports by refiners	0	10	10
		29	18	47
	Net Shortfall	**-9**	**-47**	**-56**

[9] CEC Study 1998

[10] Capacity Impact is based on CARB Phase III Compliance Plans as submitted by individual refiners to the ARB and shared with the CEC in their aggregate form

The net effect of phase out of MTBE by year-end 2002 is therefore a supply reduction of 56 TBD, or 5.5%. The actual shortfall versus demand will depend on which growth scenario will unfold, and in case of rapid economic recovery, the latent demand could open up the gap between supply and demand at a rate of an additional 20 to 25 TBD per year, and the shortfall could reach an unprecedented 100 TBD in 2004.

Also significant is that Table 3.1 clearly shows how the Southern California markets that are served by the LA Basin refineries are much more affected by the MTBE phase out than Northern California. Of the 56 TBD shortfall, 47 TBD or 84% will be in the south. This is an important distinction because the logistic infrastructure is currently already more constrained in the LA Basin than it is in the Bay Area.

It should also be noted that this forecast assumes sufficient ethanol supply to meet the minimum blending levels of 5.7% volume ethanol. While ethanol supply should be sufficient, the logistics to move ethanol from the Midwest to the California markets are complex and not all issues have been resolved. If large scale ethanol movements were to start by year-end 2002, rail coordination, tank car unloading, marine receipts, and distribution to gasoline truck terminals would all be areas where significant operational problems should be anticipated.

The 8 TBD shown in Table 3.1 as excess MTBE was used either because of supply problems with ethanol for the current substitution of MTBE by some refiners, or used by LA refiners to make up for volume and quality problems by blending in more than 11%.

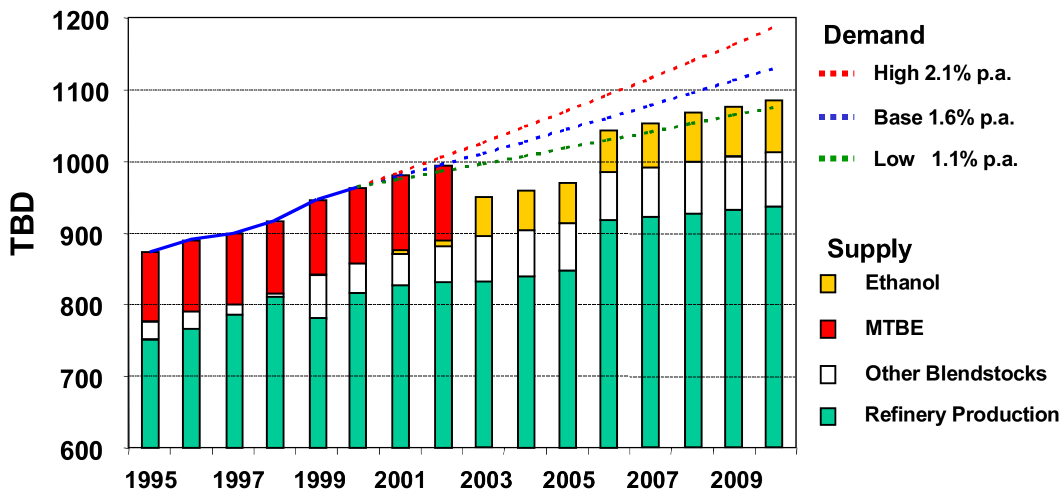
The major addition in refinery capacity of 22 TBD shown in Table 3.1 above is not a net addition, but a partial conversion of conventional gasoline production into CARB Phase III grades [11]. It is clear from Table 3.1 that the southern California market will be impacted much more severely by the MTBE phase out than its northern counterpart. Moreover, the LA Basin is more constrained in terms of import capabilities than the Bay Area, making the south more vulnerable to supply shortages.

3.2 Forward Looking Supply/Demand Balance

First, a simple supply and demand balance can be constructed for the California gasoline market by itself, ignoring for the time being the regional split for the Northern and Southern refining centers, as well as the demand for other gasoline grades supplied from California to the neighboring states. Figure 3.1 below gives this simplified supply and demand forecast.

[11] Information received during Stakeholder Meetings.

Figure 3.1 — CARB RFG Supply/Demand Forecast



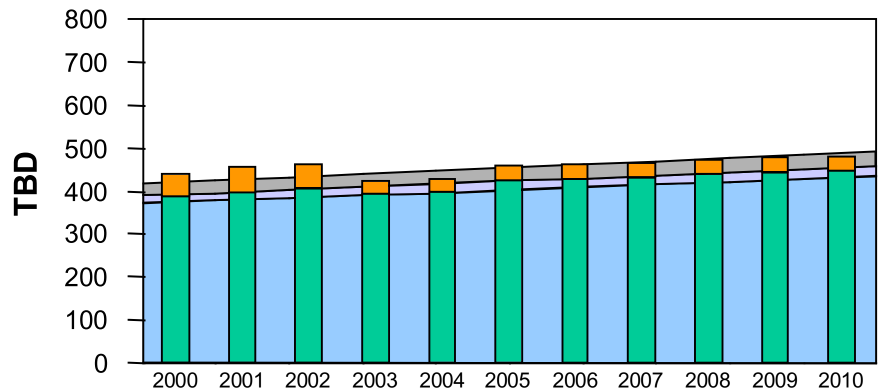
The forecasted numbers for 2002 through 2005 take into account the following projects and anticipated events:

- Phase out of MTBE beginning in November of 2002. The phase out will result in a net loss of 56 TBD from the finished gasoline pool, as per Table 3.1 above.
- Future projections for 2003 are based on CARB Phase III Compliance Plans as submitted by industry participants and only shared for this study in their aggregate form.
- The increased capacity in Northern CA includes the expansion of the Avon Golden Eagle refinery, as negotiated as part of merger agreements[12].
- Fuels production numbers assume an average 1.0 % capacity creep across the industry, a figure consistent with the observed expansion over the period 1995 — 2000, net of increased imports of blending components, see Figure 1.3
- The increased capacity for Southern California does not assume the restart of the former Powerine refinery, owned by CENCO Refining and now slated for demolition.

Figure 3.1 shows how for California as a whole, the base case shortfall of 56 TBD can open up to 100 TBD in case of rapid economic recovery and associated higher demand growth. For the base case scenario, a more detailed breakdown of the supply/demand balance is developed below, showing regional differences and production numbers by grade.

[12] Information received during Stakeholder Meetings for the Strategic Fuels Reserve Study.

Figure 3.2 — Northern CA Gasoline Supply/Demand Balance



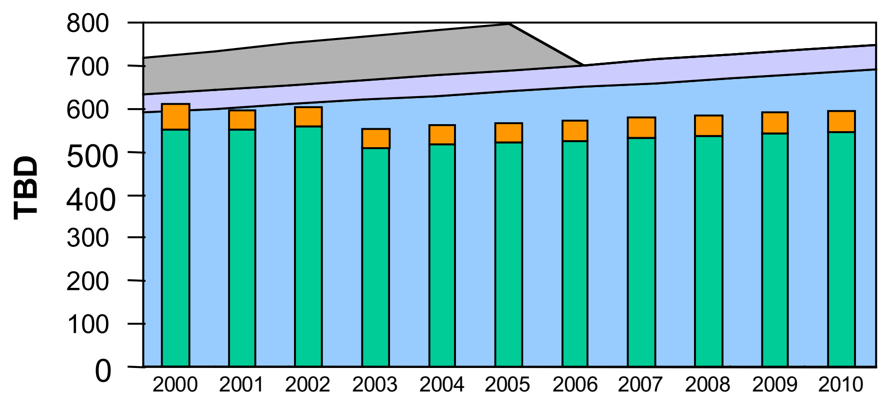
Demand

OR	28	28	29	29	30	30	31	31	32	32	32
N-NV	17	18	18	19	19	20	20	21	22	22	23
N-CA	372	378	384	390	396	403	409	416	422	429	436

Supply

CONV	52	58	54	31	31	32	32	32	33	33	33
RFG	386	398	404	395	399	425	429	433	438	442	447

Figure 3.3 — Southern California Supply/Demand Balance



Demand

AZ	87	91	95	99	102	106	0	0	0	0	0
S-NV	41	43	45	47	48	50	51	53	54	55	56
S-CA	591	600	610	620	630	640	650	660	671	682	693

Supply

CONV	58	43	44	44	45	46	47	47	48	49	50
RFG	549	552	558	511	516	521	526	532	537	542	548

From Figures 3.2 and 3.3 it will be clear that whereas northern California is only minimally impacted by the MTBE phase out, southern California will see its import dependency approximately double, which is represented in the charts as the difference between the areas and the bars. More importantly, the south currently depends for its shortfall in CARB RFG on barge imports from the Bay Area to the LA Basin.

While the Bay area will be roughly balanced again once the all planned major refinery projects are completed, the south will still be significantly short even when the Longhorn pipeline will be extended to Phoenix. The shortfall will be even more acute when a rapid economic recovery will spur the demand to growth rates of 2% and more, as seen in 1996 — 2000.

3.3 Impact of California s MTBE Phase Out on Neighboring States

The gasoline supplied by California refineries to neighboring states is different in quality to suit the various markets, and the MTBE phase out will significantly impact the supply options.

§ **Oregon.** Currently, certain refiners in the Bay Area who have an excess capacity of conventional gasoline send this product to Portland by barge. As part of the CARB Phase III compliance plans, roughly half of this conventional gasoline capacity will be upgraded to produce CARB RFG. This will force Oregon importers to source product elsewhere, most likely from refiners in the Pacific Rim. It is likely that the cost of the incremental barrel and the average barrel in Oregon will increase slightly.

§ **Northern Nevada.** Conventional gasoline is used in Reno, and will still be used after California s MTBE phase out. Although Northeastern Nevada also receives truck supplies from the Salt Lake City refining center, Reno will remain dependent on pipeline supplies from the Bay Area. After introduction of CARB Phase III, refiners are likely to use Nevada as a convenient outlet for streams that have to be removed from their gasoline pool in order to meet vapor pressure, distillation and sulfur specs. This in turn may lead to a widening quality and price gap between CARB phase II RFG and conventional gasoline. If the differential grows sufficiently large, it may provide incentives for refinery projects. Long-term it is conceivable that refiners in the Bay Area will convert more local production to CARB, and switch Reno to imported conventional gasoline.

§ **Southern Nevada.** In the winter months, gasoline distributed for Las Vegas is blended with 10% ethanol, brought in by rail from the Midwest, in order to meet CO requirements. During the summer months, Las Vegas uses conventional gasoline. Trucks from Las Vegas make deliveries to southern Utah and northwestern Arizona. It is not anticipated that the Southern Nevada area will be significantly impacted by California s MTBE phase out. Similar to Northern Nevada, initially the market is likely to form a convenient sink for non-conforming refinery streams, while longer-term refiners may have incentives to upgrade the material as the gap between CARB grade gasolines and conventional widens.

§ **Arizona.** Arizona s fuel supply is delivered from California and Texas/New Mexico by pipeline, while trucks bring in fuel to northeastern Arizona from the small refineries in New Mexico and from terminals in Las Vegas. Fuel quality is determined by geography. Outside of Phoenix and Tucson, conventional gasoline regulations are followed. In the Tucson area, gasoline is oxygenated with ethanol in the winter. Area A, essentially metropolitan Phoenix, has an ethanol oxygenated winter season and an MTBE oxygenated summer season. Summer gasoline can be either Type 1 (Federal RFG II) or Type 3 (CARB Phase II). According to the Arizona Department of Weights & Measures, most summer gasoline is Type 1, and most of the gasoline currently provided by the LA refiners to Arizona is Type 1. Arizona has adopted legislation to phase out MTBE six months after the phase out of MTBE in California. It is unclear at this time if the summer Area A gasoline will be required to be blended with ethanol. The phase out of MTBE in Arizona will tax the industry s already strained capacity to produce conforming gasolines.

4 ALTERNATIVES TO MAKE UP SHORTFALL

Barring a relaxation of the clean fuels requirements, the only solution to avoid the projected supply shortages with their associated price spikes in the wake of the MTBE phase-out, is to identify additional supplies. In principle, three possible alternative sources can be explored: increases in California refinery capacity, imports from other refining centers in the US, or foreign imports. Each of these alternatives will be explored below.

4.1 California Refinery Upgrades

Since the California refiners are well aware of the impeding shortfall and anticipate continued healthy refining margins in the foreseeable future, it can be safely assumed that each refiner has carefully examined all the options and technical possibilities to maximize output from their installations while meeting the impending requirements of CARB Phase III. The compliance plans filed by the California refiners to the CARB however show net reductions in gasoline capacity for all but a few of the installations. Several factors contribute to the reductions:

§ Maintaining the maximum allowable vapor pressure while adding ethanol requires removal of pentanes and butanes during the summer blending season, which affects most of California s gasoline demand during 9 months of the year. Besides a net loss of 45 TBD on an annual basis, the removal of these Liquefied Petroleum Gas (LPG) type materials also causes significant logistical problems for the refiners.

§ Maintaining T50 and T90 distillation requirements means that some of the components that previously could be routed to the gasoline pool now will end up as distillates. This accounts for a net loss of 10 TBD.

§ In general, the permitting restrictions that were referred to in Section 1.1 above as related to capacity creep, notably restrictions flowing from CAAA Title V operating permits and the difficulties to secure emission offsets or credits, also apply to discrete projects to meet CARB Phase III requirements.

§ The single largest capacity increase presented as part of the CARB Phase III Compliance Plans at any refinery is the conversion of 22 TBD of conventional gasoline into CARB grade at a Bay Area refinery. Although engineering and project activities are reported to be progressing satisfactorily while the refinery is changing ownership, the permits and emission credits for this project have not yet been secured. It is also important to recognize that this is not a net addition in capacity, and displaces the problem from

CARB gasoline to conventional gasoline now shipped from the Bay Area to Northern Nevada.

- A further addition of 22 TBD of gasoline at the same refinery will result if idled facilities are restarted. This project reportedly has marginal economics and a new owner will have to support an investment decision. This capacity is not expected to come on-stream before 2005.

- The former Powerine refinery, which CENCO attempted to revive and which might have added 22 TBD of CARB-grade gasolines to the Southern California pool, where the shortfall is greatest, was offered for sale by CENCO but found no takers at mutually acceptable conditions. The refinery is now slated for demolition[13], so that the site can be redeveloped for light industry. Pressure by environmental action groups and continued litigation over already granted permits played a significant role in the decision to abandon the project. The same action groups were also a factor in a recent decision by another LA refiner not to proceed with a capacity expansion.

In summary, the CARB Phase III Compliance Plans as submitted by the industry indicate a net reduction in refining capacity, despite strong incentives for refiners to maximize production. Moreover, the permitting climate is not conducive to other capacity additions in the near term.

4.2 Waiver of Federally Mandated Oxygen Requirement

The State of California is currently contesting the federally mandated minimum oxygen content in reformulated fuels, claiming that the same environmental benefits can be obtained with other formulations. If a waiver of the oxygen requirement were to be obtained, it would mean that the phase out of MTBE does not automatically usher in ethanol as the only viable alternative oxygenate. The benefits of a waiver are mainly derived from the fact that the problems associated with ethanol s high vapor pressure impact would be avoided:

- The current suppliers of Phase II base gasoline blendstocks would still be able to ship to California.

- Within the California refineries there would be fewer net production losses due to removal of light components.

[13] OPIS Alert January 22, 2002.

§ Ethanol would still be used in smaller quantities, but at prices not dictated by a mandated minimum presence, but by blending value and cost of other alternatives.

The disadvantages are that the non-oxygenated reformulated alternatives are not necessarily easier to produce, still involve significant capacity loss, and would require even more complex logistics, because it would still involve having to accommodate ethanol in the distribution system in addition to clear gasolines.

The concern is also that the industry has been focused on ethanol as the replacement for MTBE and that all engineering studies and projects necessary to comply with CARB Phase III requirements have been based on replacing MTBE by ethanol. A last minute change to other alternatives may create significant problems if the MTBE phase out date is maintained on the original schedule.

4.3 US Gulf Coast Supplies

The US Gulf Coast is the largest refining center in the US, and as such is a logical place to consider when looking for alternative supplies to meet California s shortfall. It has always been recognized that the CARB Phase III requirements would make sourcing finished product or CARBOB from the PADD III refineries difficult, but it is the availability of other blendstocks that needs to be evaluated, as well as the capabilities of the transportation system to move any available product to the West Coast.

4.3.1 Product Availability

Currently, a number of US Gulf Coast refineries are capable of producing gasolines that are at or near CARB II specifications, and most of these have made occasional shipments to California in the past. However, it is not economical for these refineries to invest in the necessary upgrades to be able to produce Phase III base blendstock, because of the limited overall production capability of the boutique quality material, the incidental nature of the export shipments, and the emergence of other premium markets for the these type of blendstocks such as the Chicago market, where high margins can be realized without the need for additional investments[14].

Not only is there no justification for Gulf Coast refiners to upgrade their capabilities to meet California specifications, there is also not much spare capacity in the PADD III

[14] Information received during a Stakeholder Survey Meeting conducted for the CEC s Strategic Fuels Reserve Study.

system overall. Much like the refineries in California, the refining centers on the Gulf Coast are currently also operating at or near maximum sustainable operating rates.

Figure 4.1 — US Refinery Capacity Utilization

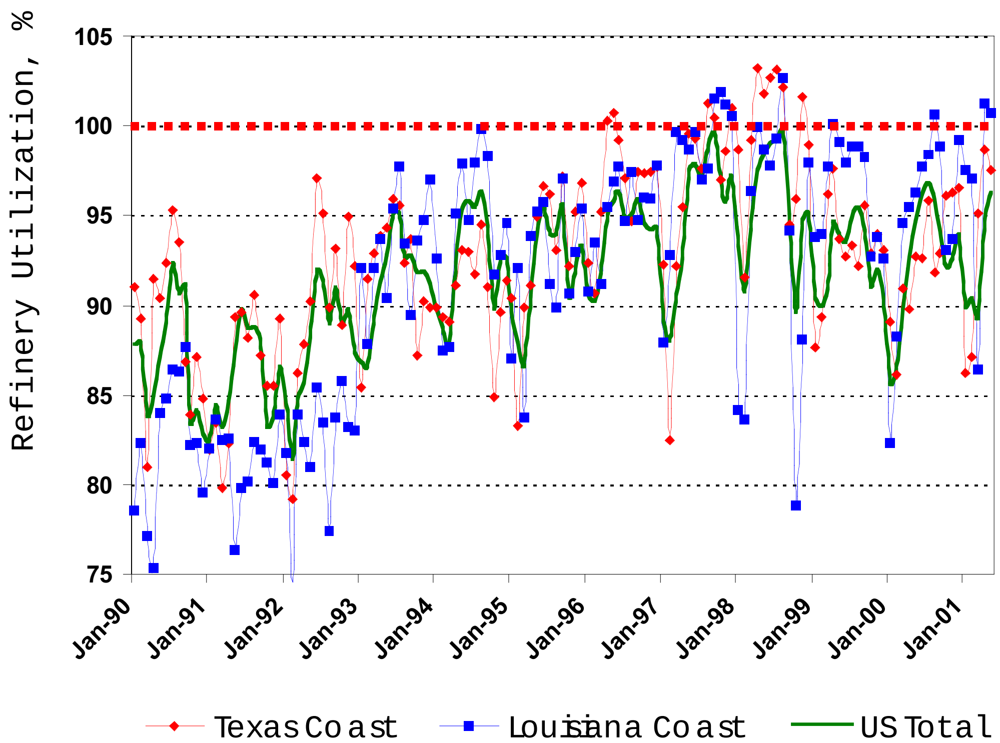


Figure 4.1 shows how refineries in the US as a whole and on the Gulf Coast in particular, have seen a steady increase in overall capacity utilization as expressed in total crude runs, from average levels of 85% in the early nineties to at or even above calendar day capacity during the seasonal peak demand periods in recent years[15]. In fact, demand now consistently exceeds capacity, and New York harbor depends on foreign imports to balance supply and demand. This means that any product shipped from the Gulf Coast to California will back out pipeline volumes to New York and will necessitate additional foreign imports into the Eastern states.

Similarly, capacity utilization in the main gasoline-producing unit within most Gulf Coast refineries, the Fluidic Catalytic Cracker (FCC), has seen a steady increase, to where

[15] Source data: EIA

these units are now running at their rated calendar day capacities and have no spare capacity left. Figure 4.2 below shows the capacity utilization of the Gulf Coast FCCs.

Figure 4.2 — Capacity Utilization of Gulf Coast FCCs

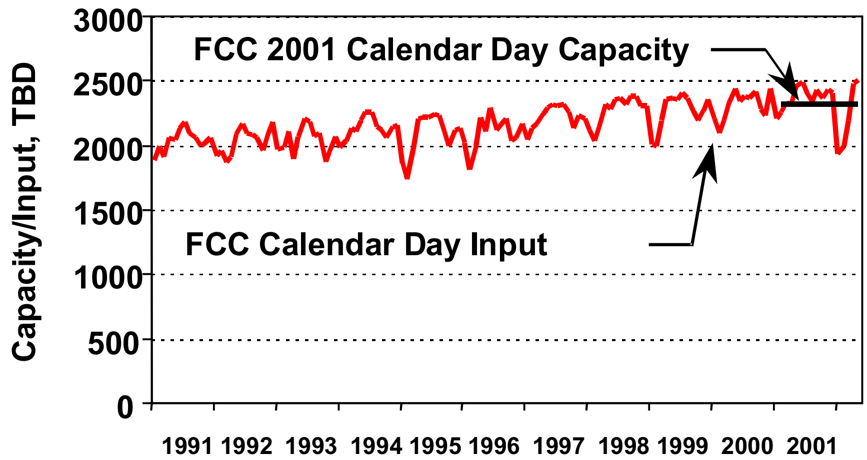


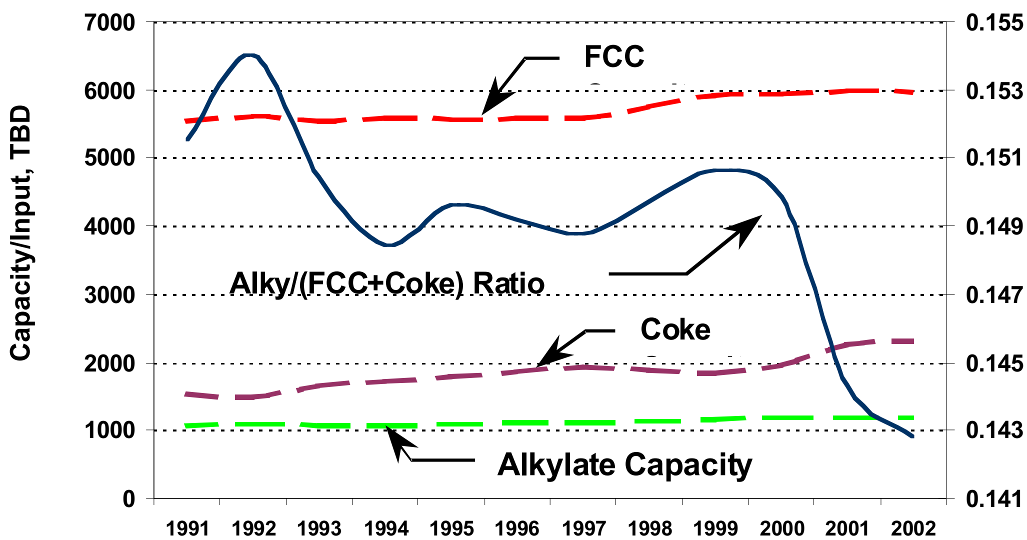
Figure 4.2 clearly indicates that except for seasonal downturns in the winter, all available FCC capacity on the Gulf Coast is being fully utilized to produce gasoline grade materials. Similarly, other gasoline-producing units in Gulf Coast refineries such as hydrocrackers and cokers are also running at or near capacity. Even though at 55 to 100 TBD, the projected shortfall for California is only 2 to 4% of the Gulf Coast FCC capacity, to satisfy the California demand would require segregation of choice blendstocks from the main gasoline pool. This in turn may have a much greater impact on the total production of finished gasoline, because for each barrel of higher quality material removed from the blending pool, a refiner may have to back out multiples of lower grade blendstocks. In an environment where all capacity is effectively utilized, this is not likely to be economically attractive.

4.3.2 Availability of Blending Components

In the absence of readily available finished product, the question now becomes whether the Gulf Coast could supply sufficient components to California. The choice blending component, which best fits the particular needs of the California refiners, is C7 alkylate. This component is produced by combining propylene and butanes in a reaction that is catalyzed by sulfuric acid or fluoric acid in a process that requires some of the most stringent safety and environmental precautions of any refinery installation.

Because alkylation units are inherently more hazardous than most other refinery operations, they have been more difficult to build and to expand because permitting is not always possible. Also, the uncertainties surrounding feedstock availability and alternative market values make investment decisions difficult. As a result, while the Gulf Coast refiners have been able to increase their capacity in FCCs and cokers, alkylate capacity has remained virtually flat, as shown in Figure 4.3.

Figure 4.3 — US Total Alkylation Capacity vs. Coking and Cracking



Source: DOE/EIA PSM

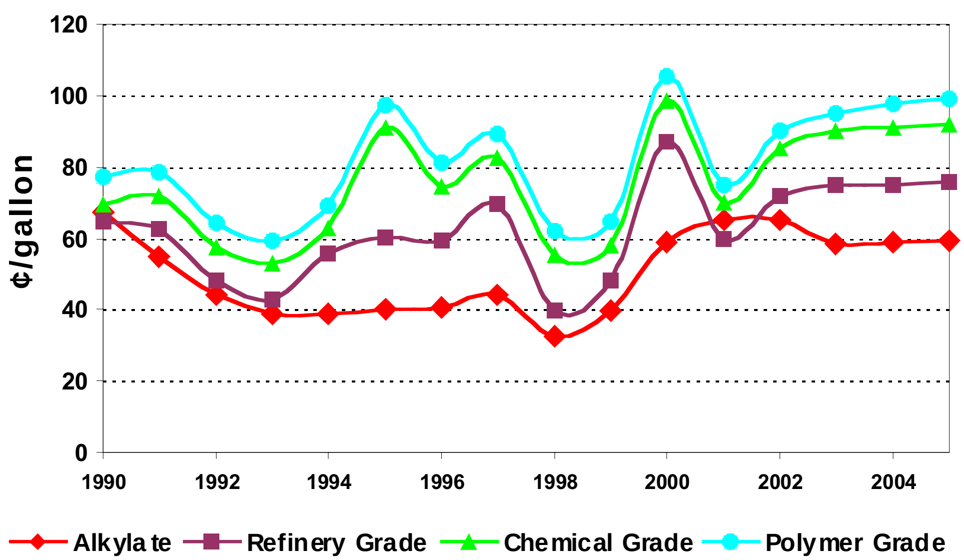
The availability of C7 alkylate is to a large extent related to the performance of the chemical markets. Normally, the value of propylene, one of the key components of C7 alkylate, is significantly higher in chemical usage than it is as a refinery blendstock. This means that it is usually much more profitable for refiners to sell propylene into the chemical markets at the expense of reduced alkylation production.

As shown in Figure 4.4 below, only twice in the last 10 years, in 1990 and 2001, has an inversion occurred whereby the value of propylene in alkylate exceeded the value as refinery grade feedstock to the chemical industry. These inversions require an economic recession, which severely impacts the chemical industry, to coincide with unusually high fuel prices.

The price inversions in 1980 and in 2001 were short lived, and in both instances conditions quickly reverted back to normal. For forward projections, it is assumed that average historical conditions will prevail, which means that the C7 alkylate will only be available if it offers a netback to the refiner equal to refinery grade propylene sold into the chemical industry. This means that a California importer will have to offer a premium of 20 cpg over Gulf Coast Gasoline, with peaks of 30 to 35 cpg if the alternate value is determined by chemical grade demand. Including transportation from the Gulf Coast, delivered cost to California would have to be sustained in the range of 30 to 55 cpg over the price of USGC gasoline to consistently attract sufficient volumes. As can be seen from Figure 1.8, this differential has rarely occurred over the last 11 years, and never on a consistent basis.

The issue of competing uses for propylene impacting the availability of C7 alkylate, and the difficulty of substituting C8 alkylate given current T50 restrictions, was extensively discussed by Cal Hodge[16] in the context of a CARB workshop held November, 2000. The conclusion drawn at the time still seems valid, in that alkylates may play some role in meeting California s projected shortfall, but their overall contribution is likely to be limited to small volumes, i.e. one cargo per month, at a significant premium.

Figure 4.4 — Propylene Values by End Use[17]



Other blending components, such as isomerate, reformate, raffinate, etc, are also likely to be available in small quantities, but will not offer the same blending advantage. In general, since refiners in the Gulf are operating at capacity, any component shipped from the US Gulf Coast to California will have to be replaced by an equivalent volume

[16] Letter by Cal Hodge, A2Opinion, to Alan C. Lloyd, Ph.D., Chairman of CARB, December 15, 2000

[17] Source of Data: CMAI

of foreign imports into New York, with pricing based on market economics rather than incremental cost of production.

Currently, no Gulf Coast producer of MTBE has announced plans to convert MTBE production capacity to isooctane (a pure form of alkylate). Even if MTBE is phased-out altogether in the USA, there are many alternative markets available worldwide for MTBE that will offer US Gulf Coast producers of MTBE better netbacks with lower risk than investment in conversion of their units into isooctane.

4.3.3 Shipping Availability

One of the considerations in evaluating supply options for gasoline and blending components from the US Gulf Coast to meet California s projected shortfall, is the availability of Jones Act ships.

Figure 4.5 — US Gulf to CA Product Movements

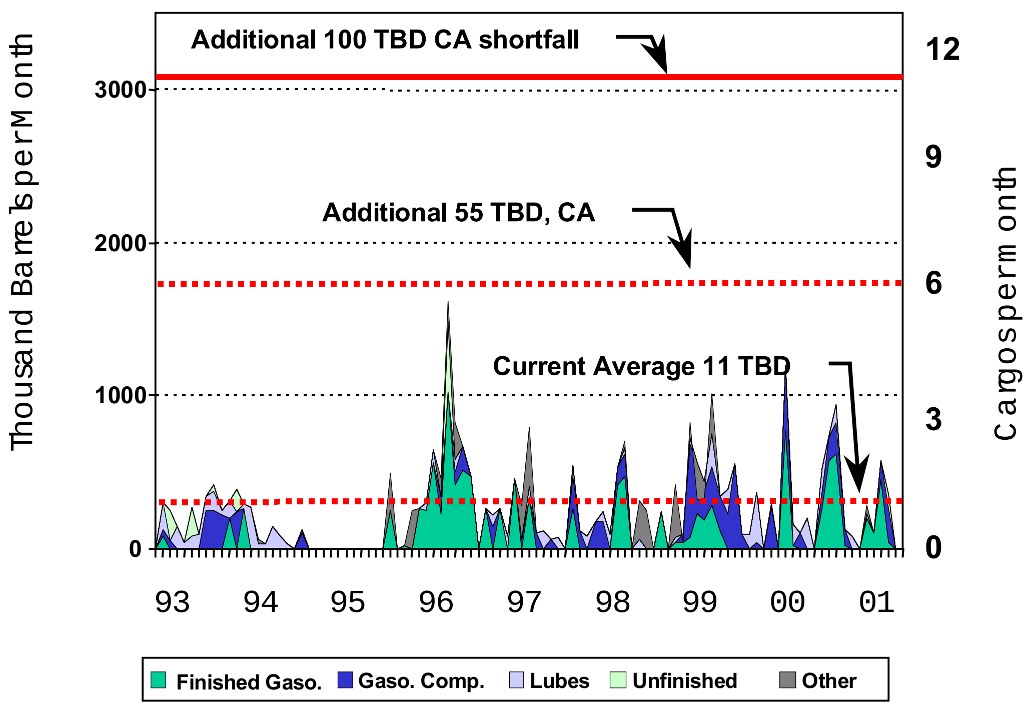
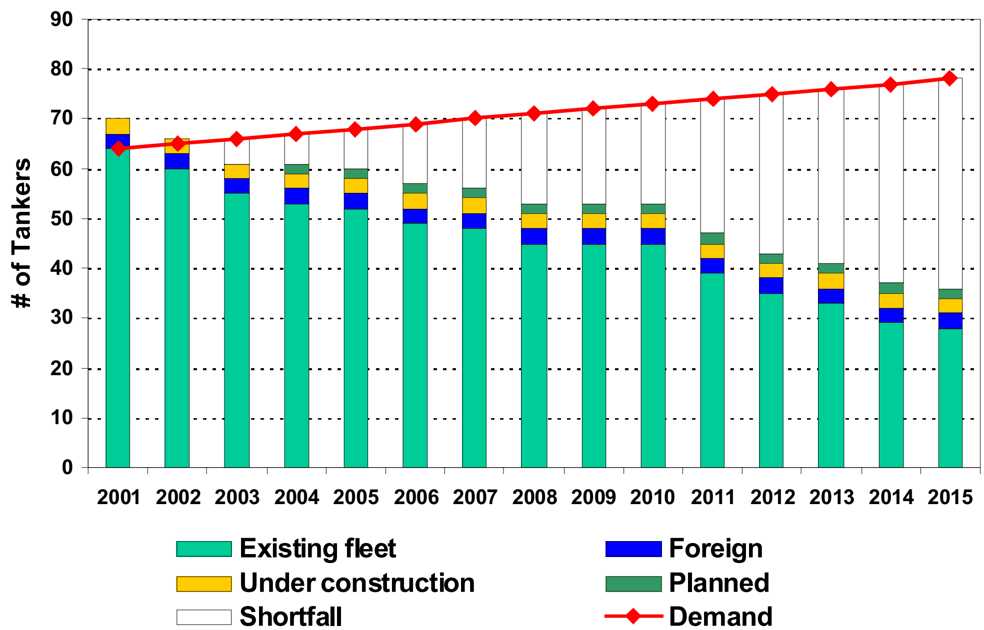


Figure 4.5 shows the historical shipping volumes in clean petroleum products from the US Gulf Coast to California, excluding MTBE. Since 1996, about 330 thousand barrels is shipped from the US Gulf Coast to California per month, equivalent to a rate of 11 TBD. At its highest monthly rate, about 6 cargoes were shipped for a total of 55 TBD. If California s projected shortfall were to be sourced in its entirety from the Gulf Coast,

shipping would have to be available on a continuous basis corresponding to the peak rate observed in 1996.

With a 44-day round trip time, one product tanker capable of carrying 275,000 bbl of gasoline can supply the equivalent of approximately 6 TBD. To move 55 to 100 TB D will therefore require 8 to 16 tankers. Currently there are 64 Jones Act product tankers in operation, but that number is slated to be reduced significantly in the near future as mandatory vessel retirement under OPA 90 takes effect, as shown in Figure 4.6.

Figure 4.6 — Availability of Product Tankers under OPA 90



Several factors make it unlikely that new building programs will prevent the projected shortfall. First, the owners are reluctant to initiate new ship building while there is still uncertainty over two major pipelines from the Gulf Coast to Florida and to Arizona, which could result in a significant reduction in maritime movements. Secondly, owners will need bankable contracts for the life of the ship before being able to finance a new launch, at locked-in rates that are substantially higher than currently prevailing market rates. The major oil companies, who are the primary class of customer to be able to commit to bankable contracts, are unwilling to lock in those rates and is taking a wait-and-see approach.

All in all, it seems very unlikely that sufficient Jones Act shipping capacity can be mobilized to help close the California supply gap by interstate movements from the US Gulf Coast, even if adequate supplies were available from this region.

4.3.4 Gulf Coast Supply Summary

The conclusions that can be drawn from the analysis of US Gulf Coast supply options are that:

§ Finished or near finished gasoline will not be available for CARB Phase III.

§ Components will be available at premiums that correspond to local blending value plus replacement imports costs.

§ Incremental supplies of the choice blending component, C7 alkylate, will be available only at premiums corresponding to alternate use of propylene as chemical feedstock.

§ Even if blendstocks can be located, there will not be sufficient shipping capacity to move the products from the US Gulf Coast to California

The development of the gasoline price differential between California and the Gulf Coast over recent years supports these conclusions. In Figure 1.8, it is clear that there is a rising trend with increasing volatility in the premium that California is paying over the Gulf Coast for its gasoline supplies. But while a price spike in 1996 was able to attract volumes from the US Gulf Coast (see corresponding spike in shipping volumes in Figure 4.5), subsequent sustained and higher price differentials in recent years have triggered only moderate volumes to be shipped from the Gulf Coast. This confirms that increasingly, the US Gulf Coast and California have become disconnected markets, with quality requirements and lack of logistical means acting as barriers to supply.

4.4 Imports from Other PADD V States

The State of Washington has a major refining center on Puget Sound. In 2000, the Washington refineries shipped around 47 TBD of gasoline and blending components to California, while California exported 35 TBD to Oregon of conventional gasoline [18]. California refiners, who own three out of four of the major refineries in Washington, often move products between

[18] US Army Corps of Engineers Waterborne Commerce Statistics Center

Washington and California in order to optimize their West Coast material balances. Given prevailing market incentives, it appears that the current volumes represent the maximum feasible interstate exchanges, i.e. if significant spare capacity had existed, it would have been used. It is anticipated that a chronic shortage of fuels in California will lead to further optimization of these inter-refinery balances and that Washington refineries, after investments, may be able to increase their exports to California by 10 TBD.

4.5 Imports of Foreign Products

Imports of foreign gasoline and blending components other than oxygenates have increased from erratic small net exports or imports in the early nineties to a level of 20 to 25 TBD in recent years. As with US Gulf Coast supplies, the availability and the logistics will have to be examined in order to establish what role foreign sources can play in alleviating a California supply shortfall.

4.5.1 Availability of Gasoline and Components from Foreign Sources

Currently, several foreign refiners are capable of producing conforming CARB Phase II gasoline or near-BOB , base-stock gasoline that only needs the addition of MTBE to be on spec. Most of these have shipped occasional cargoes to California over recent years. A survey of these refiners completed as part of the Strategic Fuels Reserve Study currently underway revealed that only the Irving refinery in New Brunswick will be able to supply Phase III CARBOB, in quantities of up to two cargoes per month or the equivalent of 18 TBD. These supplies do not require Jones Act shipping and can therefore be delivered at competitive freight rates (8 cpg) and at relatively short notice (3.5 weeks transit). It is likely that most or all of this material will find its way to California if supply shortages cause prices in California to depart substantially from East Coast levels, where the New Brunswick refinery currently sells most of its output.

Another Canadian source of material is Alberta s Envirofuels, which has plans to convert its 18.5 TBD of MTBE production into 11 TBD of isooctane. This material is targeted for the California market, and the project is likely to be driven by the need to move condensates from natural gas production rather than stand-alone economics, which would have forced Envirofuels to require significant premiums, given the conversion cost and the complicated logistics to move product from Edmonton, Alberta, to CA. Chevron, who is part owner in this venture, is likely to keep their share of the output within the Chevron system and use infrastructure released from MTBE service, while shareholder Neste may put their volume onto the open market.

In Dubai, a new venture called Isooctane currently produces approximately 10 TBD of CARBOB, based on blends of isomerate and reformate. Isooctane has plans to increase production to 25 TBD, and make improvements to meet CARB Phase III specs. With current freight rates of 10 to 12 cpg, first supplies from this source have started moving into California in the fall of 2001.

Other than the three specific foreign sources of CARB Phase III blendstocks, it can be safely assumed that the international majors such as ExxonMobil, British Petroleum (BP) and Shell, will be able to optimize the availability and usage of high quality blending components within their global refining systems, so that these materials will be routed to California when a price departure offers an opportunity to maximize corporate revenues on a global basis.

All in all, it would appear therefore that additional supplies up to 50 TBD could be mobilized at premiums over world market pricing that are not too different from California s higher historical price levels, although this volume does not appear to be committed to California at this time. Whether global availability of premium blendstocks will allow sourcing of 100 TBD seems a little more doubtful at this stage, but given sufficient incentive, i.e., if California s prices were to remain for a prolonged period at levels of more than 50% over world markets, then it is likely that the State will attract every available conforming barrel that refiners around the world can segregate and ship. The problem therefore becomes one of import logistics: how well equipped is the State currently to rely on foreign imports for a substantial increment in its gasoline supplies, and how will this increased import dependency impact overall reliability of supply?

4.5.2 Required Logistics Infrastructure

The gross shell barrel storage capacity in service for gasoline and blending components, including oxygenates, at commercial terminals that are capable of receiving maritime imports in California is close to 16 million barrels, of which almost half is in terminals owned by refiners offering third party services when space allows. In addition, most refineries are capable of receiving imports of gasoline and blending components into tankage located at the refineries, which totals 27 million barrels in the State. Table 4.1 provides a breakdown of this tankage.

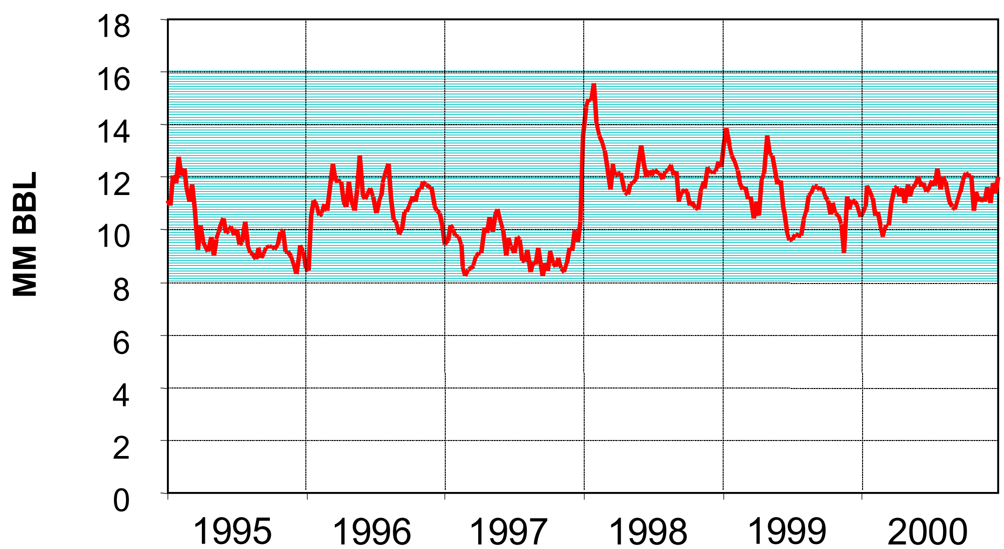
Of the refinery tankage, most is in operational service for storage of process rundown streams, blending and final product delivery. These tanks cycle on a frequent basis and cannot be used for receipt of imports, which require large tank volumes to be empty at the planned arrival date of the ship, and then to be drawn down slowly.

Table 4.1 — Tank Capacity for Gasoline, Blendstocks and Oxygenates[19]

MM bbl	Inside Refinery	Commercial Terminals	Refinery Owned Terminals	Total
Bay Area	**13.3**	**3.8**	**0.6**	**17.7**
LA Basin	**13.7**	**4.6**	**6.8**	**25.1**
Total	**27.0**	**8.4**	**7.4**	**42.8**

As shown in Figure 4.7, the effective working range for inventories of gasoline and blending components in California refineries is from 8 to 16 million barrels, or between 30 and 60% of the total gross shell capacity. This narrow range confirms that inventories in this tankage are managed to suit operational needs. The effective working range of 8 million barrels represents less than 8 days of consumption, which is a very narrow operating margin in terms of security of supply.

Figure 4.7 — CA Refinery Inventories of Gasoline & Components[20]



[19] Data from OPIS terminal Encyclopedia 2000, ILTA 2001-2002 Annual Directory, and from Survey Meetings conducted for the CEC Strategy Fuels Reserve Study.

[20] CEC Inventory Data

Because refinery tankage is so tight, most refiners have allocated a minimum number of tanks to MTBE service. For the most part, MTBE is received directly into the refinery over the refiner s dock, or into the semi-commercial facilities owned by the refiners. Tank space allocated to MTBE is determined largely by the need to receive full cargo parcels, i.e., up to 300,000 barrels at one time. When MTBE is phased out and refiners need to import several alternative products, such as CARBOB, isooctane, two grades of alkylate, ethanol and other blending components, the determining factor for tank size will remain the cargo size. The issue is further complicated by the need to provide a separate tank for each product throughout the distribution system. Some MTBE tanks will be useful for the alternative materials, but the tankage system does not have the capacity or the additional number of spare tanks to meet the requirements of so many new streams.

The increase in imports of petroleum products from less than 100 TBD in 1996 to over 250 TBD in 2000 has been largely accommodated in the commercial storage terminals. If a throughput of one time the tank size (one turn) per month is taken as a representative industry norm, than the increase in imports represents utilization of 4.5 million barrel of tank capacity. It is this increase that has caused tankage, which was readily obtainable in the mid-nineties, to become very tight in the current markets, which has resulted in an increase in rental rates of more than 50%.

Especially in the LA Basin, tank space for all products from crude oil to clean, is currently extremely difficult to find, and those refiners that had leased out tank space before to traders and other third party importers, were forced to restrict tankage for internal usage. Moreover, with tank space tightening, local refiners entered into long-term agreements for most commercial tank space, replacing the trading community which tends to rent tanks on a spot basis for periods generally not exceeding one year.

In this environment, with tankage already so scarce that importers of products sometimes have to send back cargoes for lack of a place to land it, replacing a single readily fungible component such as MTBE that is largely handled within the refinery s internal infrastructure, with a string of boutique blendstocks that will require individual tankage in large sizes, because the products are brought in from remote locations and require full cargoes for shipping economics, is expected to result in severe supply problems.

4.6 Pipeline Supplies

California s current product pipeline connections only serve to export fuels from the State to northern Nevada and western Arizona, for a total of 130 TBD of various gasoline grades in

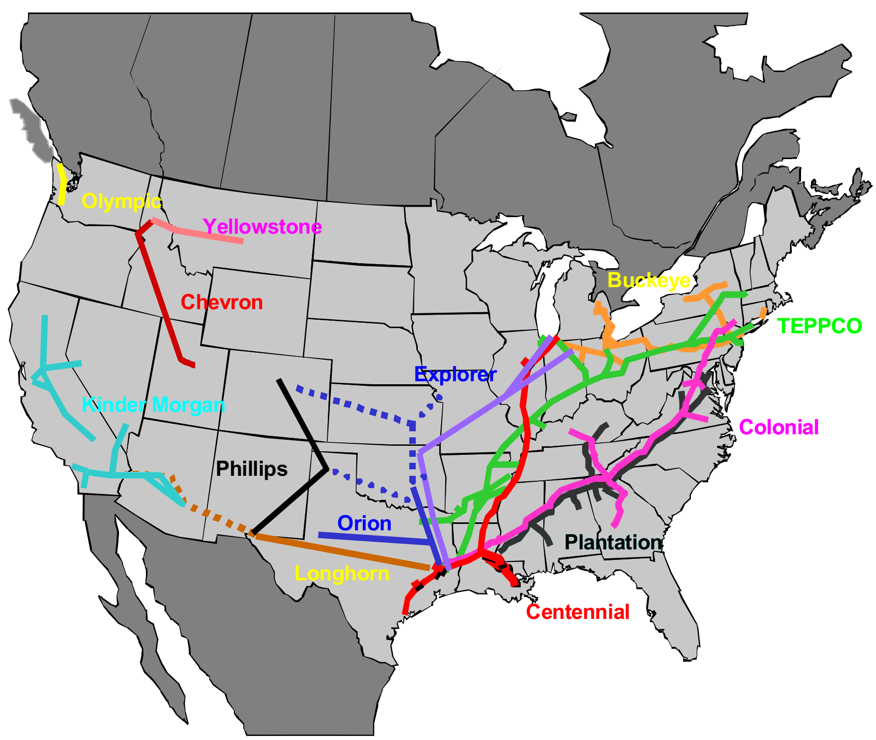
2000. Several projects are under review that would either directly or indirectly alter the California fuel supply/demand balance.

4.6.1 *Longhorn Pipeline*

The Longhorn pipeline project is based on the conversion of an existing crude oil line into clean product service and reversing the flow. The project has been held up for a number of years because of permitting related litigation, notably in the city of Austin. The actions were sponsored for the most part by a refiner in New Mexico, whose operations would be threatened by the arrival of supplies from the Gulf Coast.

Currently, it would appear that the legal battles have been decided in Longhorn s favor, with a recent decision by a federal judge allowing Longhorn to proceed. In a first phase, to be completed by mid 2002, Longhorn will be able to ship up to 75 TBD. Later phases of the project will provide for expansions to 225 TBD with the addition of new pumping capacity.

Figure 4.8 — Main US Product Pipeline Systems



Once product from the Longhorn pipeline reaches El Paso, it is anticipated that Kinder Morgan East Line will be looped to permit additional product movement all the way to Tucson and Phoenix. This study assumes that product from the Longhorn pipeline could be flowing to Phoenix by 2005 - 2006, replacing exports from southern California and relieving the pressure on waterborne imports into Los Angeles.

The Longhorn pipeline will only bring relief to California to the extent that it replaces volumes currently exported from the State, thus freeing up internal supplies. A concept that has also been considered by California legislators is the construction of an entirely new pipeline from the US Gulf Coast to California for the express purpose of supplying the State with a substantial portion of its future fuels requirements. This potential expansion will only bring relief to California to the extent that it replaces volumes currently exported from the State, thus freeing up internal supplies.

As can be seen in Figure 4.8 above, the Longhorn pipeline would link the California refining system to the major product distribution grid east of the Rocky Mountains. This grid is important because it links the largest US refining center on the Gulf Coast with the major gasoline import market of New York. Thus, the system can be balanced from both ends, with the highly liquid futures market as a mechanism to hedge price uncertainty on forward contracts. California would greatly benefit from a link to this system. It is questionable however in how far the limited capacity link formed by the proposed Longhorn pipeline would allow an effective arbitrage of gasoline prices between the California markets and the rest of the US.

4.6.2 Other Long-Term Possibilities

Another option currently being evaluated by the CEC under the terms of AB 2098 is that of a new pipeline to be routed from the US Gulf Coast to California parallel to Longhorn. What appears to be a fundamental flaw in this concept is that there is currently no spare refining capacity on the Gulf Coast that would be able to feed this pipeline (see Section 4.3.1 above). This means that in order to feed the new pipeline, the equivalent of a new refinery would have to be built, specifically designed to produce California grade fuels. A new world scale refinery with sufficient capacity to base-load a large diameter commercial pipeline in a range of 200 to 300 TBD is likely to cost in excess of $3 billion, with the pipeline to cover the 1500 miles from Houston to Los Angels adding another $1.5 billion.

If the only reason that a new refinery to serve California s fuel needs is built in Texas is that permitting a refinery in California is no longer possible, than there are other alternatives that would make more sense than the US Gulf coast. For instance, a new refinery could be built just south of the border on the Baja coast, for the same or even less money than in Texas, and could be connected to the California grid by less then 100 miles of pipeline instead of 1500 miles.

None of these projects is seen as feasible in a timeframe that would make a difference for the decision to phase out MTBE by the end of 2002.

5 IMPACT OF SHORTFALL

The impact of a shortfall in general will be that of higher prices, until a price level is reached where demand is impacted to such an extent that demand is in equilibrium with the reduced supplies. There are however significant differences in short and long-term price elasticity, as well as in the way price increases affect different market segments over time.

5.1 Price Effects

The effect of price on demand of gasoline, often referred to as the price elasticity of gasoline demand, is defined as the percentage change in the demand of gasoline divide by the percent change in price. Thus, a price elasticity of — 0.1 for example, suggests that a 2% fall in demand would correspond to a 20% increase in price.

The price elasticity for gasoline is not a constant number over a wide price range, but will be a function of other factors. For instance, overall price level will play an important role: at low overall price levels, i.e., when crude oil and energy prices are low, the same percentage price increase will not have the same impact on demand than when prices are already high. Also, general economic conditions and regional factors such as availability of public transportation alternatives will play a significant role.

Moreover, there will be a significant difference between short-term responsiveness and long-term elasticity. Longer term, the effect of continued high pricing, such is for instance the result of fuel tax policies in many parts of the world, will have an impact on overall vehicle fleet fuel economies. Short terms, these effects are negligible. Therefore it is not surprising that estimates given in the table below have fairly wide ranges.

Table 5.1 — Gasoline Price Elasticity

	Short-Term	**Long-Term**
FTC (2001) Midwest Gasoline Investigation	- 0.1 to - 0.4	Not reported
WSPA (2001) (PIRINC study)	- 0.05	Not reported
API (Porter) (1996)	- 0.19	- 0.71
Haughton & Sarkar (1996)	- 0.12 to - 0.17	- 0.23 to - 0.35
Espey (1996)	Not reported	- 0.53
Goel (1994)	- 0.12	Not reported
Goodwin (1992)	- 0.27	- 0.71 to - 0.84
Sterner (1992)	- 0.18	- 1.0
World Bank (1990)	- 0.04 to - 0.21	- 0.32 to - 1.37
Dahl (1986)	- 0.13 to - 0.29	-1.02

The overall range of reported numbers seems to suggest a short-term elasticity of — 0.2 (range of — 0.04 to — 0.40) and a long-term elasticity of — 0.7 (range of — 0.23 to — 1.37). A short-term elasticity of — 0.1 corresponds well with the observed behavior in the California market in 1999 (see Figure 1.7), when a 10% shortfall caused prices to double (- 10% / - 0.1 = 100%).

The likely short-term effect of the 5 to 10% shortfall that would result if MTBE were to be phased out by year-end 2002 is therefore that spot prices in California would increase to levels 50 to 100% over national levels. These prices are unlikely to last more than several months to maybe half a year, because at this level, supplies will be attracted on a global basis, and the differentials are so large that sub-optimal logistics and high logistics costs need not be an obstacle. In the case of the 1999 refinery outages, prices remained twice the pre-outage level for a period of approximately 6 weeks, when alternative supplies could be brought into the Bay, which is less constrained in terms of logistic infrastructure than the LA Basin.

5.2 Long Term Effects

Longer term, the shortfall will be reduced because alternative supplies will be mobilized, mainly through foreign imports and improvements in terminal capacity. With the incremental barrel determining the price in the market as a whole, the long-term price level is likely to be determined by import premiums. Given transportation costs from remote locations, this premium on a delivered basis is likely to be in the order of magnitude of 20 to 30 cpg over world market prices. I.e., if New York harbor gasoline moves in the range of 50 to 70 cpg, California gasoline based on import premiums and logistics costs can be expected to be between 70 and 100 cpg.

Before unique specifications severed the arbitration mechanism between the California gasoline markets and those on the East Coast, price differentials between the local market and the US Gulf Coast hovered just below the transportation cost differential of 8 cpg (See Figure 1.8). The subsequent disassociation of the two markets has resulted in a premium that is increasingly determined by foreign import pricing differentials, i.e., California prices currently average about 10 to 20 cpg higher than current premiums.

If a long-term price elasticity of - 0.7 is assumed, then the long-term effect of a 20% price increase would be an almost 30% reduction in demand. However, such a large reduction in demand would lead to a reduction in imports, and a subsequent price drop. The net effect of this will be an increasing instability of the California gasoline markets, with a cyclic nature that has the potential of being disruptive and detrimental to the economy of the State. This effect is indeed observed in Figure 1.8. The net effect of a 20 cpg differential is approximately $3 billion per year of revenues paid in excess of normal economic rent, mainly to out-of-state parties.

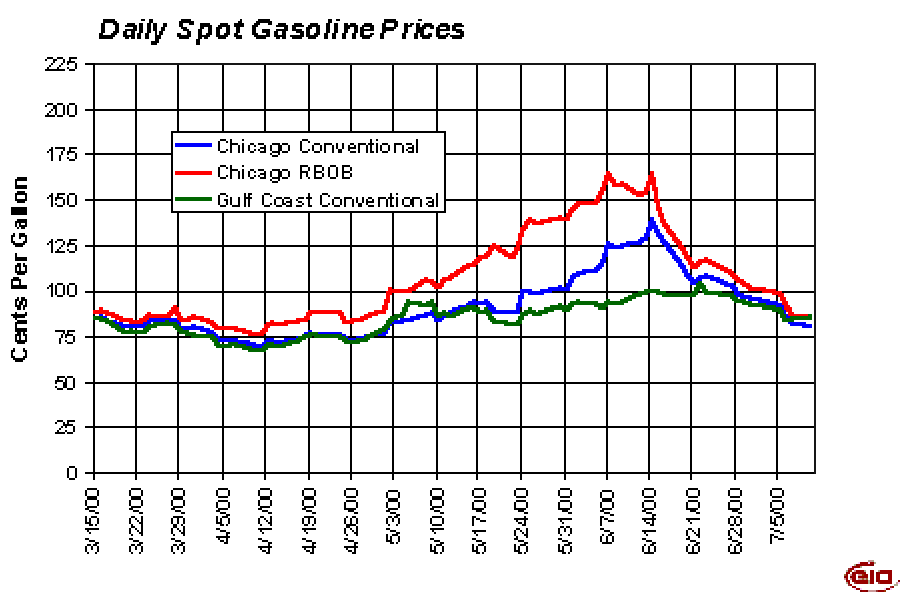
5.3 Confirmation of Anticipated Price Impact by Recent Market Events

Two recent gasoline market events confirm the price impact as predicted on the basis of generally accepted price elasticity numbers, namely the 1999 California supply disruptions and the 2000 Chicago gasoline market.

The impact of the 1999 supply disruptions in the California gasoline market was discussed already in Figure 1.7 above. Essentially, a series of major and minor unplanned refinery outages caused shortages ranging from 50 to 80 TBD. Although most of these outages occurred in the Bay Area refining center, spot prices in both Northern and Southern California quickly rose to more than double the prior level. The elevated price levels were sustained over periods of 4 to 6 weeks at the time, with severe price volatility in between, and only came down after one of the affected refiners applied to the California Air Resources Board for a waiver to supply non-conforming gasoline.

In the spring of 2000, a series of events led to a prolonged price spike in the Chicago market [21], namely the transition to low Reid Vapor Pressure (RVP) RBOB blended with ethanol, supply shortfalls caused by refinery and logistics problems, and long re-supply lines with products hard to find because of unique product specifications.

Figure 5.1 — Spring 2000 Chicago Gasoline Market



[21] Joanne Shore, *Supply of Chicago/Milwaukee Gasoline Spring 2000*, EIA Staff Report, http://www.eia.doe.gov/pub/oil_gas/petroleum/presentations/2000/supply_of_chicago_milwaukee_gasoline_spring_2000/cmsupply2000.htm

As can be seen in Figure 5.1, the effect of the shortage was that spot prices roughly doubled. In her report, Joanne Shore drew the comparison between the Chicago incident and the anticipated California phase out, pointing out the striking similarities of market insularity, with unique specifications and constrained supply routes.

5.4 Comparison with Power Crisis

A comparison with the power crisis seems apt: there are many similarities between the 2000/2001 power situation in California and the looming shortage of gasoline. There are however some fundamental differences too, and both similarities and differences are listed in Table 5.2 below.

Table 5.2 — Comparison of Gasoline Situation with Power Crisis

Power	Gasoline
Similarities	
Steady increase in demand	Steady Increase in demand
NIMBY prevents new capacity from being built	NIMBY prevents new capacity from being built
Access for supplies from outside the State is restricted by logistic limitations and commercial barriers (HV transmission lines, market dominance generators)	Access for supplies from outside the State is restricted by logistic limitations and commercial barriers (shipping and terminals, market dominance refiners)
Market in hands of few players	Market in hands of few players
Price in the market set by last increment	Price in the market set by last increment
Primary energy carrier constrained (natural gas pipeline capacity)	Primary energy carrier constrained (crude oil terminal capacity)
Differences	**Differences**
Generation deregulated, but distribution and retail markets restricted	Free market, upstream and downstream
No inventories	Small but functioning inventories
Completely fungible commodity	Unique specifications
Small shortfall causes immediate disruptions (black-outs)	Small shortfall cause price spikes rather than outage
Consumers have many short-term options to reduce demand without great inconvenience	Consumers have few short-term options to reduce demand without great inconvenience
Peaker plants can be realized in 6 to 9 months	Capacity additions (refinery projects) take years

Overall, the parallels are sufficient to give cause for reflection. The general public is likely to see these parallels too, and it is likely that the outrage over a gasoline crisis if it were to occur would be even more outspoken than was the case for electricity, because contrary to the electricity crisis, warnings over the impending gasoline shortfall after MTBE phase out have been numerous, and the consumers have less flexibility to voluntarily curtail gasoline demand than they had for electrical power.

5.5 Likelihood of Outcome Scenarios

Various assumptions underlie the demand forecast and supply scenarios, resulting in a multitude of possible outcomes that vary in degree of probability and economic impact. Below, an analysis will be made in qualitative terms of particular sets of circumstances that need to combine in order to produce a certain outcome scenario. Based on the likelihood of the key contributing factors, the overall probability of such a scenario will be estimated.

5.5.1 Scenario with Least Economic Impact

A scenario with the least economic impact is one in which the California gasoline supply and demand balance does not significantly worsen over today s situation. For this to happen, the following conditions must be satisfied:

§ The net impact of the MTBE phase out and ethanol substitution of California refinery production of gasoline is not more than 5%.

§ California s economy slides into a deep recession, combined with crude oil prices in excess of $30/bbl, which cause gasoline prices to be high despite low demand. The combination of a weak economy and high gasoline prices wil keep demand flat.

§ Imports do not significantly increase over current volumes, and remain within the capabilities of the existing infrastructure, in particular in the Ports of Los Angeles and Long Beach. Sufficient US flagged product carriers are available to transport the domestic share of California s increased imports.

§ Adequate supplies of ethanol are available at reasonable prices, and no logistical problems occur with rail and ship receipts.

§ There are no significant refinery outages or other supply disruptions.

The likelihood for each of the constituting factors is quite low, and their combined probability therefore makes this scenario highly unlikely, i.e., the combined probability is estimated to be less than 10%.

5.5.2 Scenario with Significant Economic Impact

A scenario with significant economic impact, in which discretionary spending of the general public is reduced by several billion dollars, with severe economic hardships for the independent gasoline marketers and their institutional buyers, is likely to be the result of:

§ A decline in California refinery production of gasoline of not more than 5%.

§ California s economy recovers and gasoline demand increases by 4.5% over 3 years.

§ 100 TBD of additional imports are needed, but only one foreign producer of conforming gasoline remains. Alkylate is difficult to find because of increased propylene prices. The infrastructure in the Ports of Los Angeles and Long Beach is increasingly scarce, and frequently, cargoes cannot be shipped because there is no tank to receive the product into. US flagged product carriers are frequently not available.

§ Adequate supplies of ethanol are available at reasonable prices, but some logistical problems occur with rail and ship receipts.

§ There is one significant refinery outage and several smaller supply disruptions every year. Market instability and price fluctuations increase.

Since each of the contributing factors has a high degree of probability, the overall likelihood of this scenario is estimated as more than 50%.

5.5.3 Scenario with Severe Economic Impact

Under this scenario, acute shortages of gasoline occur will become a matter of routine, with severe and prolonged price spikes at unprecedented levels that affect most California consumers and cause a significant political backlash.

§ Refinery projects to compensate for the volume loss associated with the phase out of MTBE are delayed. The net loss of production of gasoline is 8%.

§ California s economy recovers before year-end 2002. Population growth, urban sprawl and low mileage cars continue. Latent demand for gasoline increases by 6% in 3 years.

- § An additional 140 TBD of imports is needed to offset the shortfall, but product availability and infrastructure limitations do not improve quickly enough.

- § Some project delays limit initial supplies of ethanol and significant logistical problems occur with rail and ship receipts.

- § There are two major refinery outages in the first year of phase out.

Several of the contributing factors are not altogether unlikely, i.e., several of the planned refinery projects are as yet not permitted, and the probability of two major refinery outages in a single year is real (7 occurred in the last 5 years, 1999 saw several outages). Qualitatively, the probability of this worst case scenario is low to moderate, i.e., 20 to 30%.

6 ALTERNATIVE SOLUTIONS

If relaxation of clean air requirements or the federal mandate for oxygenation are not negotiable options, then the only alternative to avoid the negative impact of chronic shortages of gasoline in California is to postpone the phase-out of MTBE, or even reconsider phasing out MTBE altogether and focus instead on measures to prevent MTBE of contaminating groundwater.

6.1 Deferred Schedules for Phase-Out of MTBE

Final recommendations deferred until after the workshop.

The preliminary recommendation is to defer the phase out of MTBE to such time that sufficient guarantees are available that demand can be met by available supplies at reasonable prices. Based on current information, this seems unlikely to be the case for Southern California before the fall of 2005, when it should be clear whether or not replacement of California s supplies to Arizona by the Longhorn pipeline will free up sufficient volumes within the State.

6.2 Actions Required to Increase Supplies

Final recommendations deferred until after the workshop.

It is important that the deferment does not become an idle respite before the next crisis. A series of specific actions must be identified to ensure that adequate supplies will be available within the shortest possible delay.

6.2.1 Facilitating Refinery Expansion Projects

Recommendations deferred until after the workshop.

6.2.2 Removal of Barriers to Imports

The Strategic Fuels Reserve Study that led to this separate study on the phase out of MTBE, contains at this stage several innovative recommendations that address the effective removal of physical and commercial barriers to supply from sources outside California. The Strategic Fuels Reserve Study will be released for public review and comment in early March 2002

6.2.3 Position viz. Unocal Patent

One of the main barriers to imports of finished products and to the participation of others than the major refiners in the importation of blendstocks to produce finished gasoline is the Unocal patent. Even though Unocal s patents have held up in court so far, the US Patent Office, in a highly unusual step, is currently in the process of reexamining the validity of these patents. The State of California is taking an active role in helping to redress a situation that is clearly harmful to the State in that blending around the paten reduces the gasoline production and increases air pollution.

6.2.4 Improvements for Ethanol Logistics

Although in the context of this Study, the availability of ethanol was never questioned, it seems likely that because many of the industry participants expected a postponement, the logistics to bring ethanol to the terminals and truck racks for blending into the gasoline will have to be improvised in many locations.

A deferral of the implementation will give the parties involved a better chance to create reliable delivery systems.

6.3 Negative Impact of Deferred Phase Out

The negative impact of a delay in the phase out of MTBE is primarily that concerns about continued or renewed leakage of MTBE into the groundwater are not addressed. Another important consideration is a delay in the expected improvements in the formation of smog forming combustion products when using ethanol as oxygenate rather than MTBE. Last but not least there are industry participants such as ethanol producers, refiners and logistic service providers who have already made substantial investments in anticipation of a phase out of MTBE by year-end 2002. These investments will essentially be stranded for the duration of the delay, incurring a cost of capital while not generating expected economic rents.

A more detailed discussion of each of these factors is postponed until after the workshop, where most of these issues are likely to be discussed in greater detail.

6.3.1 Environmental Impact — Groundwater

To be completed after the workshop.

6.3.2 Environmental Impact — Air

To be completed after the workshop.

6.3.3 Economic Damage from Temporarily Stranded Investments

To be completed after the workshop.

7 RESULTS OF MEETINGS AND WORKSHOPS

To be completed after the workshop.

8 PRELIMINARY CONCLUSIONS

Final conclusions will be formulated after the workshop. Preliminary conclusions are listed below.

8.1 Current Market

- California demand for gasoline continues to be strong, despite the recent economic slowdown. If not impacted by supply shortages, continued high growth scenarios are at this point more likely than moderate to low demand growth.

- The California refining system, hampered by a restrictive permitting environment, has been unable to keep up with demand growth. Most investments by the industry in recent years have been focused on compliance issues, and have not resulted in significant new capacity.

- The California refineries are running as close to the theoretical maximum capacity as can be expected for installations of their age and complexity. Still, unplanned outages occur at a total rate across all installations in the State of 1 major incident and 8 minor incidents per year.

- Demand in excess of the indigenous refining capacity has been met by imports, and California is now depending for 15% of its gasoline demand on imports, primarily of blending components, primarily MTBE. The increase in imports over recent years has been sourced from foreign countries.

- The shortfall occurs primarily in Southern California, and most imports are received in the ports of Los Angeles and Long Beach. The logistic infrastructure in these ports is currently fully utilized, with the tank market being very tight and cargoes regularly unable to find a place to offload.

- In addition to physical barriers such as the unavailability of tankage, there are commercial barriers that prevent an adequate flow of imported gasoline or blending components, notably California s unique specifications, illiquid markets, lack of hedging mechanisms, and restrictions imposed by the Unocal patents.

- The combination of limited local capacity, restrained imports, limited storage, and a strong demand, has caused the California gasoline market to become increasingly unstable, with wild price swings caused by small amounts of over or under supply.

8.2 Impact of MTBE Phase Out

- Implementation of the CARB Phase III requirements, with replacement of MTBE by ethanol, will result in a supply shortfall of 5 to 10% for the California gasoline pool as a whole.

- Industry studies and recent experience in the California market indicates that a 5 — 10% shortfall translates into price levels 50 to 100% higher than normal, i.e., prices will move in the range of \$2 to \$3 per gallon when crude oil pricing and refinery operations would normally have resulted in pricing around \$1.50 per gallon.

- With some of the initial price elasticity removed by chronic shortages, the market will become increasingly vulnerable to supply disruptions such as refinery outages, and it is likely that price spikes can reach \$4 per gallon.

9 PRELIMINARY RECOMMENDATIONS

To be completed after the workshop. Preliminary recommendations are listed below.

9.1 Deferment of MTBE Phase Out

A deferral of the MTBE phase out until November of 2005 should be sufficient to complete the necessary steps to ensure that a transition to ethanol can be accomplished with minimal disruption to gasoline supplies and least costs to California s consumers.

9.2 Actions

The intervening period must be used to:

§ Identify ways to allow refiners to expand capacity in cost effective ways, with permitting procedures revised to enable one-stop, fast track processing, similar to that introduced to resolve the electricity crisis.

§ Implement the recommendations of the CEC s Strategic Fuels Reserve Study, which are being developed in parallel to this MTBE study. The preliminary recommendations of the SFR study are to create additional storage, as well as means to promote forward liquidity.

Attachment 1 —